THE NUTRITIONAL STATUS IMPACT ON INFANT AND CHILD MORTALITY IN KENYA: A MACRO-LEVEL ANALYSIS

BY

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TO MY SIBLINGS

D E C L A R A T I O N

THIS THESIS IS MY ORIGINAL WORK AND HAS NOT BEEN PRESENTED FOR A DEGREE IN ANY OTHER UNIVERSITY.

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THIS THESIS HAS BEEN SUBMITTED FOR EXAMINATION WITH OUR APPROVAL AS UNIVERSITY SUPERVISORS

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A C K N O W L E D G M E N T S

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A B S T R A C T

The main objective of the study is to determine the impact of nutritional status on child mortality in rural Kenya, and also to describe feeding practices and prevailing socio-economic and environmental conditions (which include the demographic characteristics of the mother, the hygienic conditions of the household, eating habits of the community and disease prevalence along with enviromnetal sanitation).

From the results it was concluded that the selected social, economic demographic, health and enviromental indicators are good predictors of child mortality in Kenya. According to the multiple linear regression equation, the selected independent variables were found to explain 71.3% (cumulated R^2) of the total variation in the dependent variable (child mortality rate). In all prevalence and incidence of illness, supplementation age and education of mothers in the community take an upper hand in explaining the variation.

On the whole, it was concluded that Child Mortality along with malnutrition in Kenya, require immediate attention with regard to the above selected factors.

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1.0 INTRODUCTION

This study will examine the impact of nutritional status on infant and child mortality along with malnutrition and mortality differentials among children and infants in 27 districts of Kenya (excluding all districts in North Eastern Province and the districts of Samburu and Turkana in Rift Valley). The study will investigate selected factors affecting nutritional status and examine their relationship with infant and child mortality. These selected factors affecting nutritional status include:- the demographic characteristics of the mother; household amenities, feeding practices and morbidity patterns of the community. The variables covered in each of these selected factors are discussed in Chapter 4.

1.1 STATEMENT OF THE PROBLEM

The association between infant and child mortality and nutritional status has been there for a long time. Studies done by Hause (1959) show that infant and child mortality has been regarded as a very sensitive index of the socio-economic level of living of a population. Other scholars have also shown that, whether gauged from a psychological, social or economic perspective, the death of an infant or small child represents one of the most costly human experiences. Every human birth is a unique event and the cost of the death of a child to the family and friends in psychological terms is inestimable.

From a social perspective, a high infant and child death rate colours the attitudes and perspective of a whole society regarding the "value of a child". A society hesitates to place too high a value on a new human life which at best, has an uncertain probability of reaching a productive adulthood. Finally, the economic cost of a prematurely terminated life is considerable, for example, the nutritional, health and medical resources spent on a child who does not live past early childhood are, from a social perspective, largely wasted resources (Mott, 1979; CBS, 1981).

Given the interest of this study in differential malnutrition and mortality, it can be noted that fluctuations in childhood mortality generally indicate instability in either environmental conditions or in the availability of food. For example, death from gastroentritis and other diarrhoeal diseases could increase in some years, and areas depending upon the type of sanitary facilities available, the source of drinking water and other interaction with the weather (Meegam, 1980).

At present it is estimated that the population of Kenya is in excess of 20.36 million (CBS 1984) and only 19.8 million in 1982 (UNFPA, 1982), but the overal level of mortality is unclear. However, projections (1985) put the current Kenyan population at even higher levels. It has been estimated that the Crude Death Rate (CDR) is probably about 14 deaths per 1000 population (Blacker 1979). At present, about one of every three Kenyans who dies is below the age of five. Thus, the impact of early mortality on the overall level of deaths is considerable. Comparatively, a substantial proportion of mortality in

impact on the Crude Death Rate would be to reduce it from about 14.3 to 11.8 deaths per 1000 population. Perhaps even more dramatically, this decline would mean that about 37,000 babies a year who now die before their first birthday would survive (Mott, 1979).

It can be noted further that while the declines in mortality over the preceeding two decades have been considerable, from a policy viewpoint, much remains to be done whether gauged from the perspective of health and medical resources or nutrition. Differences in the chances of survival for infants and children from different socio-economic backgrounds or geographic areas are still considerable. Indeed, infant and child mortality rates even in the more favourable segments of the society are still well above those in most economically developed countries of the world. This study hopes that improvements in nutritional status will substantially reduce overall infant and child mortality.

Further, it can be noted that the magnitude of the malnutrition problem (poor nutritional status) can best be appreciated by considering its impact on infant and child mortality, the relationship between malnutrition and mortality, and the extent of malnutrition among the survivors. Malnutrition causes minor childhood disease to become killers.

This study is based on secondary data collected in the 'Third Rural Child Nutrition Survey of 1982'; and the Ministry of Health, Health Information Bulletin, Kenya,

1982. It is the intention of this study to provide a basis for the understanding of nutritional status as a factor of population change in Kenya with regard to infant and child mortality in terms of nutritional status, it is the aim of the Kenya Government to work at the improvement of the overall well-being and the quality of life of the Population.

1.2 OBJECTIVES OF THE STUDY

The aim of the study is to determine the impact of nutritional status on infant and child mortality (this study will involve children living in rural Kenya). The study also discusses and investigates feeding practices and the prevailing socio-economic and environmental conditions and their effect on the health status of infants and children. The specific objectives of the study will include:-

1. To study some of the factors which affect the nutritional status of children and infants. Such factors include the demographic characteristics of the mother (marital status, education level and age of the mother).
2. To examine the hygienic conditions of the household (with special emphasis on household amenities).
3. To examine the eating habits of the community i.e. to determine feeding practices such as breastfeeding pattern, food sources, food preparation and feeding methods.
4. And lastly, to determine and examine the effect of environmental conditions on nutritional status and

on child and infant mortality with special reference to disease prevalence and enviromental sanitation.

1.3. STUDY JUSTIFICATION

The few studies (e.g. those cited in the literature review) that have been carried out in both the rural and urban areas in Kenya indicate that malnutrition is a major public health problem. It is the responsibility of the government (along with the individual and the community) to see to it that its people are properly fed, for no successful economic development can be achieved by people who live under conditions of poor health and nutrition.

The government therefore needs ongoing information about the nutritional conditions of the population and the level of childhood mortality, and factors that influence them, since problems cannot be defined and policies formulated in the absence of information.

Of the many causes of illness and death among infants and children in Kenya and other developing countries, malnutrition is recognised to be the most important. It is well known that malnutrition, apart from its direct effects on general health, also exerts an indirect deleterious effect by lowering resistance to infectitious diseases. However, the exact magnitude of the contribution of malnutrition to total infant and child mortality is difficult to assess in view of other interelated factors. Poor families in Kenya, who constitute a vast majority of the population, are not only undernourished but live under incredibly unhygienic and unsanitary conditions. While these and other factors considered in this study are responsible for the high infant and child

mortality in Kenya and other developing countries, malnutrition also plays an important role.

Expectant and nursing mothers, infants and children constitute vulnerable groups of a population from the nutritional standpoint, and merit special consideration in programmes and studies on infant and child mortality. The usual diets of expectant and nursing mothers along with infants and children in most parts of Kenya and many of the developing countries (i.e. India and most African countries) have been found nutritionally inadequate, and the special needs of pregnancy, lactation, infancy and childhood seem to have received little consideration in many parts of the world. The status of physiological stress from the point of view of nutritional adequency may aggravate chronic dietary inadequency and this may adversely influence the course and outcome of pregnancy, foetal growth and health and growth of the child. It must be emphasized therefore, that a priority should be given to a study of maternal and infant-child malnutrition, and of possible preventive measures (Nutrition [General W.H.O. 1962]).

This study is considered important and should merit special interest in that the contribution of infant and child mortality to the total loss of years of human life and because its level is relatively high in Kenya; its causes tend to be largely distinct from those which operate at the older ages of childhood; its measurement provides a useful index of the status of health and also the standard of living of a society, and its prevention has been and is a major preoccupation of the health authorities, and the degree of success of health

programmes could be ascertained on the basis of the observable decline in infant and child mortality.

The problem of relationship between nutrition and infant-child mortality may be examined under the following considerations:-

Firstly, the available facts regarding infant-child nutrition in Kenya; the problem they pose in terms of sickness and death; and lastly what can be done to solve them under existing conditions of poor health services, unhygienic and unsanitary conditions in many parts of rural Kenya.

Although this study was not done at the Government's request, it is hoped that the government or any other interested organization would be able to use the information provided as:-

i. A basis for decisions to be made in formulation of policies in planning, and management of programmes relating to improvement of food consumption pattern, nutritional status and infant-child mortality levels.

ii. Analysis of causes and associated factors affecting childhoood mortality and nutritional status, as to permit a selection of preventive measures which may be or not be nutritionally oriented.

1.4.1 THEORETICAL FRAMEWORK

The conceptual framwork in this study will incorporate the already mentioned selected factors (i.e. household amenities, maternal factors, feeding and morbidity patterns) and their impact on nutritional status and infant-child mortality. Any theoretical framework or analysis which considers these factors singly is inevitably

an oversimplification of reality; from the point of view of policy, however, it is necessary to identify those factors which are both determinant and amenable to change. This study will consider in more detail the above factors which the author hopes are pertinent to programme activities in the rural areas of Kenya. Childhood mortality is the result of a complex set of inter-related factors of both a biological and environmentsl nature. From the conceptual point of view, it is useful to distinguish the factors that affect nutritional status and childhood mortality. The framework in this study is based on the premise that the social conditions of life are major determinants of child survival, and that those determinants make their impact directly and through a set of intermediate mechanisms that can be decomposed analytically, within this multi-layered framework. Death is a direct consequence of a set of factors originating in the social conditions of life and behaviour of mothers. Here, it is hoped that the selected factors will have a direct and indirect effect on child mortality. And that factors like length of breastfeeding and age at supplementation from the point of view of feeding practices in this framework will reflect the nutritional status of the child.

The relationship between nutritional status and child mortality will become clearer after the aforegoing variables have been operationalized.

The relationship postulated in this study borrow greatly from that developed and proposed by Chen (1983) and Mosley (1982). Mosley and Chen's conceptual framework is based on the premise that the social conditions of life are major determinants of child survival, and these determinants make their impact through a set of intermediate mechanisms that can be decomposed analytically; and that within this multilayered framework; disease and death are direct consequences of a set of factors originating in the social conditions of life and behaviour of families.

The framework proposed and developed by Mosley and Chen from the study of determinants of child survival in developing countries incorporates both social and biological variables and integrates research employed by social and medical scientists. The framework is also based on the premise that all social and economic determinants of child mortality necessarily operate through a common set of biological mechanisms, or proximate determinants, to exert an impact on mortality. The framework is intended to advance research on both social and public policies and medical interventions to improve child survival.

Traditionally, according to Mosley and Chen, social science research on child mortality has focussed on the association between socio-economic status and levels and patterns of mortality in populations. Correlations between mortality and socio-economic characteristics are used to generate causal inferences about mortality determinants. Income and maternal education for example are two common measured correlates and inferred determinants

of child mortality in developing countries' populations. Specific medical causes of death are generally not addressed by social scientists, and the mechanisms by which socio-economic determinants operate to produce the observed mortality differentials remain a largely unexplained 'Black-Box'.

Mosley and Chen further argue that medical research focuses primarily on the biological process of diseases, less frequently on mortality per se. Studies of cause of death attribute mortality to specific disease processes (such as infections of malnutrition), using information obtained from death reports or clinical case records. Clinical trials assess the therapeutic effects of a particular medical technology. Field intervention studies measure the effectiveness of personal preventive measures on levels of morbidity and mortality in a population. Epidemiological studies may define mechanisms of disease transmission in the environment, for example, the connection between environmental contamination and disease. Intervention studies alter the environment to reduce research focuses on breastfeeding, dietery practices and food availability as they relate to nutritional status. The dependent variable mostly measured, in medical research is morbidity that is, the manifestations of disease processes among survivors - usually calculated as the incidence and prevalence of disease states in a population. The ultimate consequence of disease for mortality in populations at large tend to be neglected, and socio-economic determinants are generally ignored or dealt with only specifically.

Mosley in 1983 improved his 1982 conceptual framwork; this model on child survival was based on several premises. He postulates that a set of proximate determinants or intermediate variables, directly influence the risk of morbidity. And that all social and economic determinants must operate through these variables to affect child and infant survival. Some of these proximate determinants, as classfied by Mosley, include maternal factors; environmental contamination, nutrient dificiency (or nutrient availability), injury and personal illness control. Each of these factors is assumed by Mosley to exert an independent outcome on child and infant survival.

While both the social and medical sciences have made major contributions to our understanding of infant and child mortality in developing countries, the differing concerns and methodologies have compartmentalized such knowledge and constrained the development of potentially more useful approaches to understanding child and infant survival. An even more critical problem is that the selection of a particular research approach usually results in a policy and programme recommendation biased along disciplinary lines. A new analytical approach incorporating social (along with demographic) and medical science and methodologies into a coherent analytical framework of infant and child survival, therefore is needed.

However, on the whole, the author's theoretical framework strives to make an improvement of Chen and Mosley's framework by incorporating all the aforementioned selected factors.

It can, however, be noted from Chapter 5 that during the Multiple regression analysis, several variables were dropped, to foster clarity and proper interpretation. Some of the variables were not used in the main multiple regression analysis because their tolerance levels were insufficient for further computation. Some of the above variables share the explanatory value of the variation which could have been explained by just one of them. This saves us the trouble of talking about each separately when in fact we are talking about the same thing.

1.5.0 THE STUDY AREA AND DEFINITIONS

This study is based on the data collected in the "Third Rural Child Nutrition Survey of 1982" which covered most of Kenya's districts (27) excluding North-Eastern Province districts. This was basically a rural survey, bearing in mind that the bulk of the country's population lives in rural areas and that any effective measures to check child mortality must take this into account.

Kenya is a fairly large country of 582,646 square kilometres in Eastern Africa, stretching from the Indian Ocean in the east to Lake Victoria in the west and from Serengeti Plains in the south to Ethiopia in the north. The country is crossed by the Equator, standing between latitudes 4°21' north; and 4°28' south; and longitudes 34° and 42° east (Ogendo, 1972).

Of more interest is the wide variety of climatic conditions which are found within the geographic grid. About 66% of the country has an average rainfall of under 50cm, a year, and only 13% of the country can expect to receive consistently 60cm of rainfall or more a year. These better watered areas are limited to the south-western area and the south-eastern coastal belt (KFS, 1978). Fertility of the soil also comes into the picture since the distribution of the fertile volcanically derived (laterized) soils favours mainly the rainy central highlands. These soils are of fine texture and high water retention capacity. In fact this area forms the backbone of the country's economy.

Kenya is divided into 4 physical regions. The narrow Coastal plain, the semi arid region of the west and north, the highlands including the Rift Valley and lastly the plateau surrounding lake Victoria. Of these regions, the highlands and the Lake Plateau are the most important and most densely populated. The highland region encompasses the area around Mount Kenya, Mount Elgon, the Aberdares Mountains, Mau Escarpment and Uasin Gishu Plateau.

Though the demographic aspects of the country have already been mentioned earlier in this study, it is felt that a detailed analysis is needed. In 1969, Kenya had a Crude Death Rate (CDR) of 17.1. On the basis of data from the National Demographic Survey conducted in 1977, it is estimated that the Crude Birth Rate (CBR) is estimated to have declined from 120 deaths per 1000 live births in 1969 to about 80 in 1979. The following is a list drawn from the UNFPA, World Population Wall Chart of 1982, on Kenya's population estimates (See table below).

Table I

KENYA'S POPULATION CHARACTERISTICS AS OF 1982

TOTAL POPULATION	19.8 MILLION
POPULATION GROWTH RATE	4.1
CBR (CRUDE BIRTH RATE)	55.1
CDR (CRUDE DEATH RATE)	14.0
TOTAL FERTILITY RATE	8.1
INFANT MORTALITY RATE (IMR)	82/1000
EXPECTANCY OF LIFE AT BIRTH (e_o)	MALE 51.2 FEMALE 54.7

Source: UNFPA 1982

This combination of increasing fertility and declining mortality has a significant impact on the growth rate of Kenya's population. If these current estimates are correct and continue to prevail, the popualtion of Kenya will be over 31 million by the end of the century (KFS, 1978).

It is felt that both the sharp decline in mortality and the apparent increase in fertility could be the consequences of the improvements in the standards of health and education since 1969. Health services have expanded and improved especially in the prevention and cure of most communicable diseases. These services, and an increase in educational levels, have raised the nutritional status of the population. A further substantial decline in the Crude Death Rate is envisaged due to a continuing expansion of maternal and child welfare services. It is hoped, however, that the continuing decline in mortality, especially in infant mortality and an added emphasis on secondary educational opportunities for women will stop the apparent trend toward higher fertility rates. Nonetheless, the Infant and Child Mortality rates in Kenya are still very high when compared with the more developed countries of the world.

1.6.0 SOURCE OF DATA

This study will utilize data collected in the Third Rural Child Nutrition Survey of 1982 conducted by the Central Bureau of Statistics (CBS) of Kenya. The study will also utilize data from the Health Information Bulletin, Ministry of Health. According to the CBS sample design, the master sample of primary sample units was stratified by district to meet the objective of obtaining data which could be disaggragated to the level of a district. The design was based on the population census of August, 1979.

According to the sample design three districts that were sparsely populated were merged into one structure for instance Narok was merged with Kajiado, Baringo with Laikipia, Lamu and Tana River with Kilifi and Elgeyo Marakwet with West Pokot. But most districts were treated separately, equated with a structure and this finally formed 27 strata. The sample, however, completely left out North Eastern Province districts and the districts of Samburu and Turkana in Rift Valley Province.

The nutrition survey was a module of the Rural Household Budget Survey (HBS) and thus there was a fixed sample proportion of 10% of the total number of Households actually listed in the sample. A cluster with for instance 130 households had 13 respondents, but this varied from one cluster to another, for each enumeration areas was estimated to have 100 households. The enumerators would visit the entire 105 sample of respondents during the nutrition survey but would only interview households with only eligible children, i.e. children aged three months through sixty months. The composition of the sample is shown in the Table 2 below.

The major differences in methodology among the three CBS Nutrition Surveys (the 1977, 1978/1979 and 1982 surveys) were:

1. The current survey covered both rural and urban areas of Kenya as did the second Nutrition Survey, however, the sample for the first Nutrition Survey covered only rural households. The two components of the Third Child Nutrition Survey were run at different times because the component of the Household Budget Survey (HBS) of whichnthe urban component of the Nutrition Survey was a moduåe, was launched much later in 1982. The urban component of the third child nutrition survey was only launched in February, 1983, and ran through April 1983. This study therefore, confines itself to the rural component because the urban component was still under processing.
2. The target population for the Third Nutrition Survey was children between the ages of 3-60 months, which is in contrast to the age range of 12-48 months and 6-60 months for the First and Second Nutrition Surveys, respectively.
3. The questionaires for the Third Nutrition Survey covered a much wider range of relevant health and social indicators. A special questionaire deal specifically with the mother's social-economic background and the household amenities. This made it possible to link each child to a mother, which was not possible with the data from the previous two surveys, and in this way this study was able to investigate potential relationships between nutritional status and the mother's socio-economic background.

4. Due to the extended-age range and the sample size which is four times as big in the Third Nutrition Survey compared to the first and second surveys, the rural component above covered almost 5,400 children from approximately 3,000 households, compared to 4,000 children covered in both the urban and rural Second Nutrition Survey and 1,400 in the First Nutrition Survey. Note that the First Nutrition Survey covered rural households only.

5. The Third Nutrition Survey is geared toward disaggragating data to district level which was not possible with its predecessors.

Measurement of variables used in this study basically included information on age, weight, and length (height), which was collected to allow for the computation of three nutritional status indices, height-for-age, weight-for-age, and weight-for-height, as well as dietary and morbidity information on the child. Information was also collected on mother's socio-economic status and information on the environment of the child (household amenities).

Length (to determine height-for-age) was determined by placing the child lying on its back on the stadiometer (length board consisting of a rigid board about 120 cm long with a head rest) with the foot rest placed firmly against the child's feet so that they were perpendicular to the base board. The child's length was then read from the tape measure to the nearest centimeter. Length rather than standing height was measured for all children. It is not possible to measure the height of children less than about 18 months old who cannot stand properly and it would have not been practical for the enumerator to carry two pieces of equipment, one to measure young children lying down and another to measure older children standing up.

Age of the child was calculated in the field by the enumarator in order to decide whether to include the child in the survey and to check the replies of the age related questions. This calculation was repeated during the editing of the data.

During the survey the enumerator was asked to rank using his own judgement the nutritional status of the child in terms of the child's build. This was a simple control question used in the editing process to check whether the computer information on the child's nutritional status was

consistent with the build as observed by the enumerator.

The information in the survey was ideally obtained from the mother of the eligible child. The enumerator also used his own observation to get some of the information relating to household social amenities.

The volume of water used in the household was estimated on the basis of frequency of fetching water per day multiplied by the container used for fetching water. Where more than one person fetches water, information on the type of container used had to be sought in order to know the total volume fetched. Getting this information however, proved rather cumbersome especially where households were using piped, unmetered water source. The enumerators had no alternative but to rely on estimates some of which were rather wild. This applied also to those who were using rain water during the wet season.

Child mortality rates were obtained by the usual indirect techniques based on asking mothers about children ever born and children survived. Child mortality rate involved children aged 3 through 60 months.

1.7.0 OPERATIONAL DEFINITION OF VARIABLES

1.7.1 DEPENDENT VARIABLE

The term 'Child' includes infants (under one year and children (1-4 years); and sometimes up to age 5. Child mortality statistics generally grouped all children from one up to four or five years old. This study will treat child mortality as that involving children aged three through sixty months.

It should be noted that child mortality in this study is used interchangiably with infant and child mortality.

It can, however, be noted that all the operational variables are shown in Table 3 below.

Table 2.

AGE AND SEX COMPOSITION OF THE 1982 RURAL CHILD SURVEY (SAMPLE)

	PER CENT BY SEX			PER CENT BY AGE (MONTHS)				
	NUMBER OF CHILDREN	MALE	FEMALE	3-11	12-23	24-35	36-48	48-60
TOTAL (NATIONAL)	5,313	50	50	17	20	23	21	19
COAST	419	51	49	15	21	21	24	19
KILIFI/TANA RIVER/LAMU	210	54	46	13	20	22	23	22
KWALE	138	50	50	17	24	20	24	15
TAITA TAVETA	71	47	53	19	20	20	25	16
EASTERN	1,195	51	49	16	20	25	21	18
MACHAKOS	517	50	50	15	20	26	21	18
KITUI	236	52	48	19	16	25	21	19
MERU	331	49	51	17	22	25	20	16
EMBU	112	56	44	11	24	25	24	16
CENTRAL	907	54	46	17	20	21	22	20
NYERI	172	52	48	19	20	21	22	18
MURANGA	309	57	43	19	17	19	23	22
KIRINYAGA	108	51	49	16	22	23	21	18
KIAMBU	205	53	47	14	22	23	23	18
NYANDARUA	113	54	46	18	19	21	20	22
RIFT VALLEY	1,227	50	50	17	21	21	21	20
NAKURU	167	51	49	15	22	26	17	20
NANDI	198	47	53	20	24	19	20	17
NAROK/KAJIADO	127	54	46	13	19	24	24	20
KERICHO	247	51	49	19	20	20	21	20
UASIN GISHU	122	48	52	17	21	17	27	18
TRANS NZOIA	103	53	47	18	19	23	21	19
BARINGO/LAIKIPIA	114	49	51	14	24	26	19	17
ELGEYO MARAKWET/ WEST POKOT	149	49	51	15	20	20	22	23
NYANZA	788	50	50	16	20	25	21	18
SOUTH NYANZA	291	54	46	18	23	24	20	15
KISII	288	46	54	13	16	29	22	20
KISUMU	106	50	50	19	22	22	17	20
SIAYA	103	54	46	10	22	20	25	23
WESTERN	787	46	54	19	18	24	19	20
KAKAMEGA	535	41	59	20	15	25	20	20
BUNGOMA	167	59	41	18	22	22	19	19
BUSIA	87	48	52	13	23	23	18	23

iii. MATERNAL FACTORS OR THE DEMOGRAPHIC CHARACTRISTICS OF THE MOTHER

The maternal characteristics that are involved in this study include level of education of the mother, and marital status of the mother. The maternal factors should be measured in terms of proportion of mothers with certain demographic characteristics. These demographic characteristics here include proportion of women with given education levels and proportion of women of certain marital status. This is because the study is concerned with Macro-level analysis.

Education of the mother (in this case proportion of mother with given level of education) has recently received increased attention because of its inverse relationship to childhood mortality as well as to the magnitude of its presumed effect (Chen, 1981). The educational level of the mother as it relates to childhood mortality is treated for purposes of analysis from the point of view of the proportion of women (mothers) with zero level of education (i.e. percent illiterate per district); percent of women with primary and secondary levels of education; University and college educational levels have been left out because of the low percentages of women in each district.

This study considers four marital statuses: single (unmarried mothers), married, widowed and divorced or separated. It is assumed that people who are married enjoy a higher level of social-economic status and besides socio-economic level, such partially independent factors as temperament, motivation and pleasures from the person's social group. In this study, divorce as a marital status is considered as an indicator of marital instability. A

higher marital instability as measured by per cent divorced and separated is expected to have an inverse relationship with child survival. The same applies to single and reverse for the married.

iv. HOUSEHOLD AMENITIES

These include cases of environmental conditions (or sanitary) under which a child grows. The effects of these environmental conditions on child survival are investigated in this study. These household amenities inclue sewage disposal. Sewage disposal determines spread of germs in the child's environment.

v. FEEDING PATTERNS

In the community (feeding patterns) are considered from the point of view of the average length of breastfeeding and mean age of supplementation of children in the community. Thus, this study considers feeding patterns of the eating habits of the community. In this study average length of breastfeeding is considered because of its role in determining the children's immunity against infection and level of prevelance of stunting. Mean age of supplementation here plays a critical role in the children's life because the time at which they are supplemented will determine their nutritional status. This also applies to the dietary habits of the community.

vi. MORBIDITY PATTERNS

This is defined as the prevalence and incidence of infections and diseases in a community (Chen, 1982). This study in this regard covers per cent of children sick in each district. This study is this case assumes a positive relationship between disease, incidence of disease and infections prevalence and childhood mortality.

TABLE 3

LIST OF OPERATIONAL VARIABLES AS USED IN DATA ANALYSIS

VARIABLE LABELS—

V01: CHILD MORTALITY RATE/

V03: PROPORTION OF SEPARATED, DIVORCED AND WIDOWED MOTHERS/

V04: PROPORTION OF CHILDREN WITH MOTHERS HAVING NO EDUCATION/

V05: PROPORTION OF CHILDREN WITH MOTHERS HAVING PRIMARY EDUCATION/

V06: PROPORTION OF CHILDREN WITH MOTHERS HAVING SECONDARY EDUCATION/

V08: PROPORTION SEWAGE FACILITIES NONE/

V09: MEAN AGE OF SUPPLEMENTATION/

V10: AVERAGE LENGTH OF BREASTFEEDING/

V11: PROPORTION ILL

1.8 LIMITATIONS OF THE STUDY

This study will cover a total sample of approximately 5,400 children aged three through sixty months from 3,000 rural sample households. There are a few limitations facing the study from the point of view of the data collected. The first limitation is that the survey left out all children aged 0-3 months and thus the analysis on infant mortality can not be considered complete. The study also faces two major limitations which sampling errors (sample size and sample bias and non-sampling errors). Non-sampling errors would include seasonal variation, uneven coverage, errors in reported age and inaccurate reading of measuring equipment, non-responses and non-co-operation from the respondents, etc. It is important to note at this point that coverage is influenced in some cases by non-cooperation, absences, or children being unmeasurable because of sickness or handicaps. These cases are normally few and would not be expected to influence the main findings of the survey. Another cautionary note must be made on the number of children found to be suffering from severe malnutrition; this would be regarded as an underestimate because the severely malnourished may have not been measured for the reasons given above.

The other limitation is that the data collected lacked information on factors like malaria per cent cases which had to be obtained from the Health Information Bulletin, Ministry of Health.

The other limitation though not yet confirmed is that of using proportions or percentages in data analysis, especially regression analysis. Some few variables are bound to share explanatory variation and this can make the results to be artificially higher than anticipated.

CHAPTER II

2.0 LITERATURE REVIEW

This study assumes that the impact of nutritional status on infant and child mortality will come out clearly as to help in formulation of policies and recommendations that will be beneficial to Kenya's rural population. This contention will be the basis of this study.

In terms of the key concepts, child mortality statistics generally group all children from one to four or five years old. Breakdowns within the age groups are seldom available.

In nutrition parlance, this group is commonly refered to as 'Pre-school children'. This study covers child mortality which includes all children from three to sixty months. This is because the first months of life (0-3) were not covered in the Nutritional Survey (Third Rural Child Nutrition Survey of (1982).

Nutrition status has been defined as the condition of the body resulting from the utilization of the essential nutrient available to the body. It may be good, fair or poor, depending on the intake of dietary essentials on the relative need for them and on the body's ability to utilize them (Krause, 1966).

The following discussion is mainly a review of literature of the various studies that have been done on nutritional status and infant-child mortality. Here, the selected factors that affect nutritional status and infant-child mortality will be reviewed separately.

2.1.0 HOUSEHOLD AMENITIES

Poor water and toilet sanitation have been found to be associated with high Infant and Child Mortality in a variety of locales (Gordon, et al., 1964; Rowland,et al., 1978; Barrel- and Rowland, 1979). Standards of environmental sanitation including an easily available, clean water supply, and the disposal of excreta and rubbish, are usually defective with an increased incidence of infections, and parasites that are waterborne, spread by flies, or due to fecal contamination of the compound. These will include diarrhoeal diseases and intestinal worms, both of much significance nutritionally (Jelliffe, 1969).

The influence of environmental sanitation on mortality and on Infant and Child Mortality in particular is one of the best documented areas in epidemiology. Despite this, poor environmental conditions prevail in many developing countries. The non-availability of safe drinking water, poor drainage, inadequate housing and the lack of a system to dispose of human excreta are still major problems. A study in India for example showed that the morbidity of children under five was highest in the rural areas of Varanasi. Examining the occurrence of illness according to living conditions, the study found that morbidity was higher in those children who lived in inadequately ventilated "Kachacha" (huts) houses which had a poor source of water supply in the form of an open well and where families defecated in the open fields (Agarwal and Katiyar, 1981).

Improvement of sanitary conditions in individual families is of course strictly related to improved income. Data from the World Fertility Survey in Sri Lanka, for example showed that the presence of toilet facilities in the household was the best indication of reduced rural Infant and Child Mortality (Meegama, 1980). While it is probable that the presence of toilet facilities is an indirect indicator of income, environmental sanitation itself is a determining factor. Studies which have examined the differences between urban and rural mortality indicate that the higher rates prevailing in the rural areas can be attributed for the most part, to more unfavourable environmental conditions (Figa-Talamanca, 1984). Many of the deaths in the first five years of life, it is argued, especially in the third world, are due to infections spread by environmental factors. One of the main causes of death during this period of life is diarrhoeal diseases, including gastroentritis. The incidence of this disease depends mainly on two factors: the availability and use of hygienically constructed lavatories and the availability of uncontaminated drinking water, unsanitary lavatories or the absence of lavatories leads to the breeding of flies and to the transmission of diseases either through food taken by the child or by the settling on or near the mouth of an infant. Similarly, unsanitary conditions can lead to the contamination of drinking water. This is especially so in those parts of rural Asia, where drinking water is drawn from wells which are just without any protective walls (Meegama, 1980). Meegama further states that fluctuations in childhood mortality generally indicate instability either in environmental conditions

or in the availability of food. For example, deaths from gastroentritis and other diarrhoeal diseases could increase in some years depending upon the type of sanitary facilities available, the source of drinking water and their interaction with the weather. A household which has no lavatory and which obtains its drinking water from an unprotected well will face hazards which will change from year to year. Also, fluctuations due to malnutrition or under-nutrition, he argues, could appear or determine the trend and level of mortality.

Further, studies done by the cholera Research Laboratory (1978,CRL) in Bangladesh indicate that the risk of death from malnutrition was further aggravated by crowded household conditions. If the better nourished and poorly nourished children were cross-classified as two housing floor space (crowding being less than 242 square feet), the mortality rate of the better nourished children rose from 19.4 per thousand to 42.8 per thousand in the more crowded houses, while for the poorly nourished children the mortality rate rose from 16.2 under less crowded conditions to 117.2 per 1000 in crowded households. Basically, the mortality rate was six times higher among poorly noursished children in crowded households as compared to better nourished children in less crowded households. This is indicative of improvements in mortality that maybe achieved in this population simply with improvements in nutrition and socio-economic conditions, in the absence of any other health service.

One of the more dominant relationship which has also been documented is that between the incidence of diarrhoeal disease and the quality of water and toilet facilities. An important

cause of deterrioration in water quality is fecal contamination. Gordon, et al., (1964), for example, argue that the immediate source of infection common to all forms of diarrhoea is feces-contaminated water. The incidence of cholera in rural Bangladesh was also found to be associated with the use of polluted water (Khan, et al., 1981).

It should also be noted that apart from water, food and cooking utensils could also serve as important vectors for transmitting contaminants. Rowland, et al. (1978) for example found fecal contamination of weaning foods and utensils in the Gambia to be a persistent threat to child health. Among the strategies as proposed by Cutting and Hawkins (1982), to eliminate the fecal-oral route are washing and other hygienic measures which could eliminate contamination at the source; the provision of uncontaminated water and food; and improved facilities for human waste disposal. For purposes of maintaining hygiene to eliminate contaminants it may be presumed that the availability of adequate quantities of water would also be important. As noted by Stein (1977), while some water-related diseases spread as a result of using polluted water, others spread because of shortages in water and the subsequent development of poor sanitary habits.

Thus it would appear that the provision of modern sanitary facilities, health education programmes and participation in community programmes, might go a long way towards reducing morbidity and mortality in many parts of the world. However, availability of better waste disposal facilities

and improvements in water quality have not always lowered child morbidity and mortality. Studies by Levine, et al. (1976) and Curlin, et al. (1977), for example, have shown no reduction in the incidence of primary waterborne diseases with the provision of unpolluted water. Scrimshaw, et al. (1968) also found situations where the construction of toilets had little effect on the prevalence of disease.

An important factor which has been suggested as a mitigating influence on the advantages of better sanitation facilities is poor, unhygienic usage habits. Gordon, et al. (1964) for example, argue that education and the proper use of sanitation facilities are essential components of sanitation programmes. They note that "The provision of sanitary facilities is the means to an end and not the basic consideration". It would thus be expected that translation of the availability of high quality water and toilet facilities into improved levels of sanitation in the home would depend on the way these facilities are used. In essence, the gross level of sanitation within the home is not dependent only on the presence or absence of facilities. Definitionally, 'Sanitation facilities' aid in the maintenance of sanitary conditions but are in themselves not an accurate indicator of the true level of household sanitation.

Further, it is indicated that poverty is usually associated with unsanitary living conditions and inadequate health care. However, alleviation of poverty is necessary to attack the root causes of poor health and nutrition. Health services and environmental sanitation are effective in reducing

malnutrition, for they reach those populations and individuals in need. To a considerable extent, this means reaching vulnerable groups (nursing and expectant mothers, infants and pre-school children) among the poor. Adequate population coverage is an essential concern of primary health care. However, conditions within poor households may prevent the best nutritional use of the available food and can certainly cause high rates of infection. People are said to be malnourished because they have consumed insufficient food and/or because they are sick

(Mason, et al., 1984).

Studies done in the Machakos District in Kenya, associated patterns of ill health to the environment of the child, among other things. This was intended to produce criteria for recognizing families with a higher than average risk of child morbidity. Such households should form the prime target for specific health promotion activities and other preventive measures. The living conditions in the study area, i.e. in parts of Matungulu and Mbiuni Location in Machakos District are characterized by a relatively high population density, marginal to medium agricultural potential and the social and economic influence of nearby Nairobi. Communal water supply, collective waste disposal, sewage and electricity are not yet available (Gemert, et, al., 1983).

Jelliffe (1969), argues that much improvement in infectious diseases of nutritional consequence could be expected as a result of improved hygienic conditions in the village, leading to clean food, clean water and a clean home.

Other intervention programmes in Kenya which are geared towards minimization of Infant and Child Mortality include those carried out and still being undertaken by the Kenya Expanded Programme on Immunization (KEPI) under the Ministry of Health. Another project under UNICEF involved in the minimization of Infant and Child Mortality in Kenya, is the 'Child Survival and Development Revolution'. The 'Growth, Breastfeeding and Immunization (GOBI) Programme; the Oral Rehydration Therapy (ORT) for control of diarrhoeal diseases among children; and the pilot project recently launched in Kwale District, are among other intervention programmes under UNICEF aimed at minimizing Infant and Child Mortality in Kenya.

2.2.0 DEMOGRAPHIC CHARACTERISTICS OF THE MOTHER

The correlation between education and Infant and Child Mortality has been known for many years in the developed countries (Hill and Adelslein, 1969). Evidence is now being accumulated from developing countries, where education of the mother emerges as the single most important factor in achieving a decline in Infant and Child Mortality.

Analysing statistics from two surveys in Ibadan City and in a rural setting, Caldwell found that different levels of maternal education in an otherwise similar socio-economic context and with equivalent access to health facilities, was the single most powerful determinant of the level of Child Mortality. A similar analysis of aggregate data from 41

different countries again revealed that the adult literacy level was the variable best correlated with mortality in infancy (UN Economic Commission for Africa, 1981). Several studies based on the data of the World Fertility Survey appear to confirm these findings, additional findings of these studies are the fact that the step from primary to secondary schooling seems to be a more important step than that from illiteracy to primary schooling. The father's education is less important than that of the mother (D'Souza, 1982). In countries where adult females are largely illiterate, however, the education of the father also emerges as an important factor in the decline of Infant and Child Mortality, when literacy or educational level is kept constant. Some well known correlates of Infant and Child Mortality such as father's occupation or rural residence lose their importance (Caldwell and McDonald, 1981).

The reasons given for the contribution of maternal education in the decline of infant and child mortality are many, varied and mostly complementary. Mother's education especially post-primary education has been associated with adoption of family planning methods and consequently child spacing which is further negatively associated with child mortality. This follows the premise that birth interval correlates with weaning and breastfeeding of the child and thus the susceptibility of the child to malnutrition, disease etc. Mothers with secondary education have also been found to have fewer children for they are said to prefer or desire smaller family sizes than those with primary level education or those with no formal education

at all. It can also be partly argued that concentration of available family resources could have and does have an indirect effect on the general welfare of the children. Literate mothers are more likely to break with traditional medicine and adopt new methods of child care. Their innovative behaviour might be better tolerated by the more conservative members of the family because of their educational status. Education might also contribute towards 'child centredness', in which case more of the family resources will be devoted to children; children may have to do less hard work; they may take fewer risks and they will almost certainly live a healtheir life. This relates to morbidity and mortality of the children, as child labour is said to be adversely correlated to child survival. Such a development of 'child centredness' might certainly contribute to the reduction of infant and child mortality (Caldwell, 1981). In Kerala (India), the evidence pointed to utilization of health services as an important advantage of educated women. They were more capable of travelling alone; of seeking medical care early in cases of illness; in asking questions of health professionals and in following the instructions accurately (Nag, 1981).

Jelliffee (1969), states that there is usually a high rate of illiteracy in developing countries, especially among women. According to him, education is a major key to the improvement of the health and nutrition of a country. Educated parents are likely to have an increasing awareness of modern ideas of nutrition, child bearing, and food production, and to realize the economic limitations of trying to rear and educate an average family.

In Bangladesh, where nutrition is an important determinant of health, there is evidence that a link exists between mother's height and birth-weight of the infant and that educated mothers bear a heavier infant with a greater chance of survival because of their own greater height and fitness (Chowdhury, 1982).

For Latin America, Palloni (1981), has shown that literacy has a much greater effect on child mortality than on infant mortality. Instances of excess child mortality are associated with a disproportioned contribution of the complex of water-food-airborne diseases. At one level simply persuading mothers not to cease giving food or drink to children, with diarrhoea could be extremely beneficial; at another level major improvements in sanitation and water supply are needed. As Palloni has argued, the extent of illiteracy in a society reflects not only the limitations of families but more importantly limitations in the capacity to organize and mobilize to full extent societal necessities. "From this point of view, the proportion illiterate in a population is less an indication of the fraction of mothers with inadequate knowledge to treat and feed a sick child.." (Palloni, 1981: 643).

Education has an impact not only through the characteristics of the individual mother but also through educational level of the society as a whole. In a country such as Cuba, which has made enormous efforts to bring health care services within the reach of everyone, differentials in levels of child mortality by mothers' education are quite small. Flegg(1982), has similarly

argued that literacy has the greatest impact on child mortality in societies with a relatively egalitarian distribution of income. There has been very little investigation of whether it is possible for education alone to have a significant impact on child mortality. No studies demonstrate that poor but educated women with limited access to effective sanitation or medical facilities nevertherless achieve significant reduction in child mortality. However, interventions for reducing Infant and Child Mortality call for multiple inputs and hence no single factor can tackle the problem.

Graham (1972), studied the influence of education and marital status of mothers on growth of poor slum children. He found insignificant differences between physical growth, as judged by height of those children whose parents had no education and those whose parents had only 1-4 years of education. The mean height quotient of the children whose mothers had five years of education was significantly higher than those children whose mothers had 0-4 years of education. At the same time Graham found no difference in height quotient between the child of mothers who had children from various partners and those who had them from the same partners.

So far, in the developing world, there is now clear evidence of differentials in child survival rates associated with the education of mothers. Data from Latin America (Behm, 1976-1978, Haines and Avery, 1978), Africa (Caldwell, 1979, Farah and Preston 1982), and Asia (Cochrane, 1980, Caldwell and McDonald, 1981) all show a negative relationship between the extent of maternal

education and the level of child mortality, although the amount of education required to produce a significant reduction in mortality varies from culture to culture.

Maternal age is strongly associated with infant and maternal survival. Most published studies from developing countries are based on hospital data which are hardly representative of the rural population. All of them, however, confirm the existence of an age band (span) in the fertile life of women during which reproductive risks are at a minimum. Both prior to, and after this age band, foetal and infant deaths are higher. In the Pan American Health Organization (PAHO) study in the U.S.A., the most favourable maternal age span was between 25 and 29 years. Early pregnancy in mothers under 20 years of age greatly increased the incidence of infant mortality due to immaturity and nutrition deficiency. Similar results were obtained by the WHO Family Formation study conducted in nine different countries (Omran and Standly, 1976; Omran and Standly, 1981), and by recent study among Malaysian infants (Butz, 1982).

The World Fertility Survey is another important source of information on infant mortality by the age of the mother. In the Bangladesh fertility survey, for example, mortality among infants of teenage mothers (ages 12 to 16) was in the order of 300/1000 as compared with 100/1000 for the women beyond age 20. The problem of maternal age is particularly important in countries such as Bangladesh where pregnancies occur early in a woman's reproductive life. In fact, in this setting, 75 per cent of the married women had their first pregnancy before age 18 (CRL, 1977). comparatively, this is a common feature in Kenya's rural areas especially the coastal area (see the date on average age at marriage in Chapter 4 and 5).

2.3.0 FEEDING PATTERNS

High mortality in the early years of life in Africa has been observed by a number of studies, and is believed to be related to specific infant feeding practices. The transition from a prolonged and inadequate breastmilk diet to an inappropriate solid food diet, combined with frequent intestinal infections contribute to high mortality in these age groups (Mondot-Bernand, 1977).

Breastfeeding is a major factor in infant survival. The known advantages of breastfeeding are many: breast milk is nutritionally ideal at least for the initial period of infancy (WHO/UNICEF, 1979). It provides immunity to a number of common communicable diseases (enhances the child's immunologic defence system, increasing resistance to disease). It is rich in antibodies. The disadvantages of artificial breastfeeding depend on the quality and quantity of the substitute foods, and on the hygienic conditions of the environment of the infants. Even under the best conditions, breastfed infants, other things being equal, have lower mortality rates than artificially breastfed infants (Knodel and Kiener, 1977).

The consumption of breastmilk in place of other food sources that may be contaminated reduces the ingestion of certain infectious agents. Breastfeeding can also contribute to child survival through extending the period of post-partum anovulation through post partum abstinence, and by lengthening intervals between births. Enhanced birth intervals have been associated with improvements in child survival (Gray, 1981, Jelliffe, 1969).

The advantages of breastfeeding for infant survival are greater during the early months of life and gradually diminish. A study in Malaysia showed that infants who were fully breastfed in the first month of life had 28.2/1000 fewer infant deaths than those not breastfed. The benefit for those fully breastfed up-to six months was 20.6/1000 fewer deaths (Butz, et al., 1982). Analogous results were obtained in a study conducted early in rural Chile (Plank and Milanesi, 1973). The importance of negative environmental conditions contributing to morbidity and mortality of non-breast-fed infants was also documented in the above mentioned Malaysian study. The chances of survival for non-breastfed infants were markedly diminished when their homes were deprived of basic amenities such as clean piped water and hygienic sanitation facilities.

While the great majority of infants born in the rural areas of the developing world still benefit from breast feeding for sufficiently long periods (WHO, 1981), the tendency to abandon breast-feeding, which originates in the urban areas is a real threat for at least two reasons. On the one hand the shift from breast to bottle feeding has a positive effect on fertility through the reduction of post-partum sterility. Unhygienic bottle feeding on the one hand, can cause an increase of infant mortality by increasing the incidence of gastrointestinal infection and diluting of artificial formulas due to high costs. UNICEF says that bottle feeding is one of the industrial world's most dangerous exports. The feeding of powdered milk often contaminated bottles has raised the mortality rate of children in the underdeveloped world (Kenya Times of 21st August, 1985, pp.12).

The threat is of particular concern in countries where living conditions have not improved sufficiently to outweigh the hazards of artificial feeding. A recent study in Egypt (Janowitz, et, al., 1981) showed that while breastfeeding was less common among more educated women, there was no marked increase in infant mortality. On the other hand, a decrease in the prevalence and duration of breastfeeding among uneducated women caused an increase in the rate of infant mortality which was demonstratably higher than that among educated women.

It has been noted that breastfeeding in developing countries is on the decline (Dwyer, 1975, Paulo, et al., 1975). Abandoning of breastfeeding as observed by Morley and Woodland (1979) is encouraged by advertising and promotional practices of baby and infant formula by manufacturers.

Dwyer (1975), found that Brazilian women rejected breastfeeding because they thought breast milk is weak, and therefore did not accept its value. Paulo, et, al., (1975) suspected that oversweetness of artificial milk and easier suckling of the bottle made infants reject the breast. They were of the opinion that ignorance of correct-nursing practices could have resulted in children preferring the bottle.

The decline in breastfeeding among more educated women is still not well understood. One study in Iran (Geissler, et, al., 1978), showed that the socio-economic level, education and access to alternative milk formula foods might provide a partial explanation for the failure of this group to continue lactation. The greatest decline in breastfeeding, however, was still confined to the low income group of the urban population.

Maternal milk does not in itself prevent malnutrition beyond a certain age. When the caloric needs of a growing infant outstrip the caloric supply in the mother's milk, the absence of appropriate and adequate food supplements cause a deficit which, together with the loss of passive immunity cause malnutrition and render the infant vulnerable to infection (Underwood and Hofvander, 1982). A study in Tunisia showed that the late introduction of weaning foods was more common in rural areas than in urban. It reflected cultural and socio-economic differences. The delay was more common among large low-income, food-deficit families in rural areas (FAO, 1982).

After weaning, the infant is vulnerable to a number of nutritional risks related to the type and quantity of nutrients consumed. Protein-Energy-Malnutrition (PEM) which in its more severe forms, is manifested by conditions such as kwashiokor and marasmus is widely prevalent in the rural areas of the developing world (Figa-Talamanca Irene, 1984).

The relationship between mortality in childhood and PEM has been established by a number of macro-level as well as micro level studies. In analysing the life expectance and infant and child mortality in 39 different countries, Berg found protein energy deficiency to be the best predictor of infant mortality among many variables such as income, urbanization, health expenditures and literacy (Berg, 1981). A similar analysis conducted by Di Giacomo showed more specifically that the crucial nutritional components were the fat, protein and calories of animal origin (Di Giacomo, 1978). An analysis of Latin American data has

revealed that mortality under age five and malnutrition can be used interchangeably as indicators of the same state of deprivation (Enderica, 1974). The child mortality rate is considered a sensitive indicator in the evaluation of any nutrition intervention programme (Austin and Zeitlin, 1981; Kielman, et, al., 1982).

The importance of nutritional deficiency in child mortality is often not registered as an official cause of death. In the Inter-American Investigation of mortality in childhood, malnutrition was reported frequently as an associated rather than an underlying cause of death. For example, sixty-one percent of deaths in children under five was due to infective and parasitic diseases and thirty-two percent of the same group was due to respiratory infection. Analysing the urban-rural differences in malnutrition associated mortality, it was illustrated that the rural rates were about twice as the urban (Puffer and Serrano, 1982).

Children from poor rural areas may start life with an adequate birth weight and achieve normal growth in the first six months. Subsequently, however, an almost exclusively starch-based diet, introduced at the time of weaning, no longer meets their nutritional requirements nor can the child absorb the bulk required to give adequate nutrition. Such children are apt to develop nutritional deficiencies which render them vulnerable to intestinal and respiratory infections and to malaria (Figa-Talamanca, 1984).

Another important contribution of dietary deficiency to Infant Mortality is through maternal malnutrition. Food taboos concerning pregnant and lactating women and infants, although gradually disappear-

ing still contribute to malnutrition. In some areas of rural Tanzania for example, pregnant women are not allowed to eat meat, fish and eggs (Sembajwe, 1980). Food taboos often discriminate against the weakest member of the family. Furthermore, eating arrangements reflecting the hierachicalorder within the household, often result in an inequitable distribution of food. In many rural areas, women and children eat what is left after the men have finished. Even when all family members eat together, young children and women are often at a disadvantage.

The type of supplements (weaning foods) and the manner in which they are given to the child affect the frequency of suckling and the duration of breastfeeding and therefore, the effect breastfeeding has on child survival.

Several studies have indicated that the use of bottles is associated with decreased suckling at the breast. Howie, et al., (1981), have shown that as bottles were introduced by Scottish women for feeding infants, the total number of breastfeeds per day declined. The use of bottles was also associated with lower frequencies of suckling in studies done in Iran, the United States and Kenya (Simpson - Herbert, 1977; Kippley and Kippley, 1972; Huntington and Hostetler, 1966; Van Steenbergen, et al., 1981). In studies done in Chile, Steckel, et. al., (1983), observed that when women fed their infants on milk in bottles, the duration of breastfeeding declined. Studies in the West Indies also support this effect of bottle feeding (Gueri, et al., 1978). Greiner, et al, (1981) stated that "The earlier supplementation is introduced, the larger its quantity, and the more it is fed by bottle, the

greater its impact on breastmilk supply". Van Esterik (1977), reported that mothers in rural Thailand, when considering breast milk supply to be inadequate, would increase it by more frequent child feedings, whereas professional women would supplement infants with infant formula.

Use of bottles has also been suggested to impart greater levels of bacterial contamination to the infant due to a greater difficulty in sterilization in comparison to more easily cleaned cups or spoons (Jelliffe and Jelliffe, 1978).

Aside from how the supplement is given, the type (caloric density), amount and frequency all influence breastfeeding performance. Frequent feedings with calorically dense foods make the child less dependent on breastmilk for nutrient needs. In developed countries, the most common supplements to breastmilk are cow's milk and formula, both nutrient-dense products easily consumed by infants. In developing countries, when milk is given, it is often diluted (Surjon, et al., 1980). Paps or gruels fed to the child are also inadequate in calories to meet the child's nutrient needs. Breastmilk, therefore, often continues to be the principal source of nutrients for the first few years of life. For example, in Bangladesh, Brown, et al, (1982) have shown that breast milk provides fifty percent of calories at two years of age.

When supplemental foods are inadequate because of low frequency of feeding and caloric density, they are less likely to interfere with suckling. In the Gambia, Zaire, and among the Ikungu, where supplementation is begun early but only provides

a small part of daily nutrient requirements, suckling frequency is high. In Zaire, the frequency of breastfeeding and the amount of milk consumed did not differ between infants aged less than six months receiving supplements and those fully breastfeeding (Hennart and Vis, 1980). The lack of adequate supplementation of breastmilk after 4-6 months post partum is associated , however, with poor child nutritional status.

The hygienic properties of the supplement contribute to the effect on child survival. Studies of the bacterial content of food and water have illustrated the high level of weaning-food contamination in developing countries. In a study in the Gambia, Barrel and Rowland (1979), found that the significant factor was not the type of food prepared, but the conditions under which it was prepared: unboiled water used to prepare foods and to wash bowls and utensils was heavily contaminated with fecal coliforms. Metal bowls and utensils were found to have infective levels of bacteria after being scrubbed with well water and palm leaves, and left to dry. They also had a seasonal variation in the level of contamination. They concluded that a large percentage of foods eaten by infants were contaminated, with bacteria to an unacceptable level, even after thorough cooking. Studies in Bangladesh and Indonesia had similar findings (Surjono et. al., 1980; Black et al, 1982).

Aside from the direct contamination of supplemental foods, the general level of environmental contamination and prevalence of infectious diseases determine the extent to which breastfeeding

performance can influence child survival. When the infection load is high, the immunologic protection provided by breastmilk is more important than when few infectious agents are evident. Availability of water reduces infection load by diluting and washing away the infectious agents. Adequate sanitation facilities help ensure the removal from the environment of infectious agents. Recent studies also have shown the high general level of contaminants on women's hands and breasts (Brunser, 1983). Use of soap in handwashing has been shown to reduce spread of disease in families exposed to Shigellae (a type of diarrhoeal disease)(Khan, 1982).

The interaction between the practice of breastfeeding and water/sanitation availability is shown by Butz, et al., (1982), in Malaysia. For children not fully breastfed in the first month of life, the mortality rate in the next five months was 94.7 deaths per 1000, if no toilet or piped water was available. This rate was reduced to 81.6 deaths per 1000 if piped water was present, to 17.3 if there was a toilet, and to 4.2 when both were present in the household. The effects on child survival of the presence of piped water and toilet sanitation are strongest where children are breastfed little or not at all.

Health care services can mediate the effects of high infectious loads. Immunization can protect children from certain infections that antibodies in breastmilk also protect against. Treatment of illness can reduce the detrimental impact, both on nutritional status and severity of morbidity and thus may reduce any noticeable effects breastfeeding could have (MCcord and Kielman, 1978).

Supplementation of the child's diet affects the quality of breastmilk consumed, the child's total nutrient intake, and the level at which pathogens are introduced to the child's gastro intestinal tract. The general infection load in the environment and availability of health care services affect the frequency and severity of illness and, therefore, the impact that breastmilk can have on preventing or reducing the severity of such illness.

Blankart (1974), carried out a survey in Kenyatta and Mathare Estates in Nairobi. His findings indicated that exclusive breastfeeding for the first six months did not result in cases of underweight. The Central Bureau of Statistics (Kenya) (1977) revealed that children weaned between six and twelve months of age had the most satisfactory growth while wasting or stunting was observed in children who were still on the breast (exclusively on breastmilk) after the age of 18 months.

In a study done in Kenya, Steenbergen (1976 and 1977), found that the breastfeeding pattern of Kamba children was as follows: All the children from birth to the age of twelve months were breastfed; between the age of thirteen to seventeen months 89% of the children in this group were breastfeeding, while between the age of eighteen to twenty-three months only 37% were breastfeeding. She found out that cow's milk was the first supplementary food to be added to children's diet. It was introduced into the diet between the ages of one and four months. Cow's milk was gradually replaced by thin porridge between the age of four and five months, given at a frequency of two to three times a day. Porridge remained a major weaning dish until

the age of two years. Ugali (maize meal) with milk or with tomato stew was given to three-quarters of the children towards the end of first year of life. A mixture of whole maize with peas or pigeon peas was eaten by only a few children under two years, as it was generally regarded unsuitable for children at this age. Thus the weaning food was said to be adequate nutritionally especially after age one year and thus tended to reduce the morbidity and mortality of the children in the area.

On the whole, however, nutrition is a complex subject. There are multiple nutrients (calorie, protein, minerals, vitamins): these nutrients interact and their biological requirements are uncertain and controversial (Waterlow, 1972). Moreover, nutritional status may be defined by several indications, including dietary intake, anthropometry, clinical signs, biochemical tests and functional performance indicators, and the congruence between these indicators is unknown. Nevertheless, there appears to be little controversy that dietary and feeding practices are important determinants of child survival and this is the definition of nutritional status that this study has undertaken (Bengao, 1970).

2.4.0 MORBIDITY PATTERNS

Malnutrition is one of the many manifestations of poverty. As such, its causes and consequences are multi-dimensional. It is well established that infection worsens nutritional status, and conversely, that malnutrition comprises host resistance against infection. The inter-linked problems of infection

and malnutrition are particularly significant with diarrhoeal and gastrointestinal illness, since these diseases are highly prevalent in poor countries often accounting for over one third of deaths among pre-school children (CRL 1977).

In one study, the mortality experience of 945 children hospitalized for diarrhoeal diseases was examined according to nutritional status at admission. Despite advanced therapeutic intervention, the mortality rate among malnourished children was over three-fold that of the normally-well-nourished children. The results indicate that malnourished diarrhoeal patients visiting health care facilities receive greater-than-normal medical attention, and even under the best of circumstances, may do poorly (CRL, 1977).

Studies done by Chandrasekhar (1972), in India, also show a close association between malnutrition and disease infection. He argues that malnutrition is also responsible for certain respiratory infections, gastro-intestinal disorders especially diarrhoea and that 25% of infant and child deaths are attributed to malnutrition in India.

In parts of Latin America, where the making and selling of mini-caskets are common sights, malnutrition has been identified as the primary or an associate cause in 57% of all deaths of the one to four year olds; it is an important factor in more than half of infant deaths and a contributor to the immaturity responsible for half to three quarters of deaths in the first few months of life (Pan American Health Organization (PAHO), 1971).

malnutrition causes otherwise minor childhood diseases to become killers, for example, respiratory and gastro-intestinal infections in Nicaragua are responsible for 15.3% of all deaths compared to 0.4% in North America. In Guatemala, 500 times

as many pre-school age children die of diarrhoeal diseases as in the United States. The death rate from measles, as a specially virulent killer when accompanied by real malnutrition was more than a thousand times greater in Guatemala than in the United States, in 1975 (Berg, 1973).

A W.H.O. expert committee in their report on "Nutrition in pregnancy and lactation"(1965) pointed out that: "Reports from many parts of the world have illustrated a general association between low birth-weights, high foetal and infant mortality rates, and diets of poor nutritive value; and it seems reasonable to conclude that undernutrition and malnutrition among mothers, especially in the developing countries contribute towards impaired maternal, foetal and infant health and vitality" (Geneva: W.H.O., 1965).

The relationship that exists between nutritional status and infection is of great importance. It should therefore, be taken into consideration whenever the nutritional status of a community is being dealt with.

The relationship between malnutritionand infection is synergistic as has been found by Scrimshaw (1968), Bennet and Stanfield (1972) and Latham (1975). Malnutrition reduces the body's resistance to infection, while infection aggravates or leads to malnutrition.

Infection affects nutrition through annorexia causing reduced food intake, raised nutrition requirements and reduced food tolerance. Mata, et al., (1967), found that children with the greatest weight gain experienced fewer days of illness. He did this by correlating days of illness with weight-gain. Parkin (1974)

found that the consequence of infections in general was loss of weight and impaired physical growth.

The clinical consequence of an infection depends on the state of nutritional inadequacy at the time the infection is acquired. An infection may have no serious consequence in a well-nourished individual, but can set off a total chain of fatal events in children who are malnourished. Malnutrition reduces the body's resistance to infections as it limits the formation of antibodies in response to antigenic stimulus. As found by Gordon (1976), it also reduces the number of phagocytes, as well as their capacity to act. This definitely results in reduced immunity to infections. Wittman, et al., (1967), found that the incidence of gastroenteritis was highest in under-weight children whereby 59% of all the patients in the lowest weight group had diarrhoea while only 16% of the normal weight children had diarrhoea. In addition, they also found that the initial response to treatment was poorest in the low weight children, who also showed a great tendency to suffer severe recurrent episodes of diarrhoea. They found that all the children under 75% of weight for age had a high incidence of diarrhoea regardless of economic status.

The consequence of infection is that malnourished individuals suffer more severe infection episodes than their well-nourished counter-parts (Cravioto and Delicardie, 1976). This has an economic implication in that total duration of sickness is increased, which makes treatment more expensive and capacity to produce goods is reduced.

People's attitude towards food during infection affects nutrient intake. There is a universal tendency to change normal diet of a patient to a liquid diet. This results in higher

(although not adequate) intake of carbohydrate at the expense of protein and vitamins.

Studies done by Delgado, et al., (1983), in Guatemala and Tomkins (1981) in Nigeria support the notion that nutritional status is associated with a greater incidence of infection. On the other, hand, a greater number of studies indicate an association with the percent of time ill with diarrhoea and with the duration of episodes of diarrhoea. Although not all studies agree, weight-for-height, a measure of wasting, tends to be a stronger predictor of future illness than height, a measure of stunting.

For children of developing countries it is obvious that exposure and response to disease are conditioned by their social, economic, and environmental miliey. In Addis Ababa, for instance, the prevalence of diarrhoea was found to vary according to housing conditions and parental education (Freij and Wall, 1979). In Bangladesh, several specific types of diarrhoea had higher incidences and longer durations in children from low-income households (Becker, Black, and Brown, unpublished Research, 1984). These differentials in rates of disease by socio-economic variables may be due to differences in child care practices, such as preparation of weaning food, boiling of drinking water, or personal hygiene (Black, et al., 1983). On the other hand, they may be due to low-income children's poor nutritional status, a factor known to be associated with more prolonged diarrhoea, (Black et al., 1984). Since the diarrhoeal diseases are composed of many specific types of illness caused by diverse bacterial, viral and parasitic enteropathogens with differing modes of transmission, the

relationship between the diarrhoeal diseases and socio-economic and environmental variables can be determined only if the epidemiology of the diarrhoeal diseases are understood.

The one human parasitic disease that has been unequivocably recognized as a cause of large-scale mortality among children in many parts of the tropics is malaria.

The pattern of infection varies dramatically with the level of transmission, which in turn varies with ambient temperature and the anopheline mosquito density, man-biting habit, and above all longevity. In areas of low transmission (Hypoendemic) few people of any age group may be infected at any time, and parasitic burdens may be low. Epidemic malaria in places of variable transmission may give high prevalence at all ages from time to time. But as transmission levels increase in endemic areas, the brunt of infection is moved to a progressively lower age group. In the holoendemic (75% malarial prevalence) malaria of the anopheles gambiae areas of West and East Africa, prevalence of malaria may reach over 90% by the end of the first year of life, and the level of malaria in most of the community is determined by acquired immunity rather than by the precise level of transmission. The first form of immunity to develop is that the gametocyte stages become infective to mosquitoes, and may already be present before age two years, though immunity to other stages in the body may take longer (Bladley and Keymer, 1984).

Studies done by Farinand and Choumara (1950), showed that there was a 40% Infant and Child Mortality reduction following a

malaria control on the Indo-Chinese Plateau. It was also found that elimination of the seasonal peak of malaria in Freetown, Sierra Leone, by larval control led to a reduction of 100 per thousand in the Infant Mortality rate. When transmission of otherwise holoendemic malaria in an area of Tanzania at Pare-Taveta was greatly reduced by residual insecticides, there was a marked fall in Infant Mortality, and when the programe was interrupted, it tended to rise again towards the former level. This method of control was specific to malaria and most unlikely to have acted significantly on other contributory causes of death (Bradley and Keymer, 1984).

The following review of studies address the effects of malnutrition on child and infant mortality in developing countries (especially Kenya).

Malnutrition is an important cause or a contributory cause of childhood mortality in developing countries. In a WHO proposed budget for 1976-77, it was shown that malnutrition was responsible for more than 55% of all the deaths of children under five years in Latin America. Cravioto and Delicardie (1976), attributed the high mortality in developing countries to malnutrition, after comparing data on child mortality from Mexico to that of U.S.A.

Kimati (1973), carried out a survey in a padiatric ward in Tanzania. The findings indicated that severe PEM caused 7.5% of the deaths while 50% of all the children who died had PEM as a contibutory factor.

In Uganda, Wharton (1971) estimated that between 5000-7000 children die yearly as a result of malnutrition. Ground (1964) did a survey in Kenya on child mortality in fifteen different hospitals. He found that PEM caused 9.9% of the deaths while kwashiokor caused 9.1%.The same survey indicated that 47% of the children who died in these hospitals had PEM at the time of admission. He also found that PEM was present in 63% of the deaths caused by gastro-enteritis while gastroenteritis was a contributory cause of death in 23% of the kwashiokor deaths. His survey was limited to children aged 0-5 years.

Khan (1966) found that PEM caused 18.7% of child mortality at Kenyatta Hospital. Likimani (1969) and Atlas (1973) claimed that malnutrition was the fourthleading cause of death in Kenya, with the age group under five affected most.

2.5.0 HYPOTHESES

The following is a list of the stated major and minor hypotheses to be tested in this study. Various statistical methods will be used to test the undergoing hypotheses and it is assumed that the given contentions will hold.

2.5.1. MAJOR HYPOTHESES

A. The demographic characteristics of the mother (i.e. proportion of mothers with certain demographic characteristics e.g. , marital status and education) have a negative effect on Infant and Child Mortality.

B. Better household amenities will have a negative effect on infant and child mortality. The household amenities here include, sewerage facilities.

C. Good feeding practices in the community will negatively influence the level of Infant and Child Mortality.

D. Morbidity patterns (disease prevalence) have a positive effect on Infant and Child Mortality.

2.5.20 MINOR HYPOTHESIS

1. Levels of education (proportion of women with given levels of education) especially illiteracy are negatively correlated to child survival i.e. the higher the level of illiteracy in a community, the lower the chances of child survival.

2. Marital status (proportion of women of certain marital status) especially marital instability is expected to have a positive relationship with infant and child mortality.

3. Sewage facilities being a measure of environmental sanitation and fecal disposal will positively influence infant and child mortality.

4. The longer the duration of breastfeeding the higher the chances of infant and child survival.

5. The higher the age at supplementation, the higher the chances of infant and child survival.

6. The prevalence of sickness among infants and children (proportion ill) in a community is positively related to infant and child mortality.

These are hypotheses which have been chosen by the author objectives and the hypotheses will be used as guide lines on which the study is based.

CHAPTER III

3.1 INTRODUCTION

This chapter lays a basis for the fourth and fifth chapters which deal with the analysis of the interrelationship between mortality and the independent variables. It concentrates on methods used in the analysis in order to draw conclusions about the survey data. It discusses the methods used in preparing the data for statistical analysis and the actual quantitative techniques used in this analysis. The various methods used in this chapter include tabulations and multivariate analysis. This includes discussions on linear regression and correlation analysis.

3.2 TABULATIONS

As social science research designs become more sophisticated and complex, there are increasing instances of studies with multiple levels of analysis. The task of data analysis is the determination of the basic distributional characteristics of each of the variables to be used in the subsequent statistical analysis. Information on distribution and variability provides the researcher with the necessary information required for selection of subsequent statistical techniques. After examining the distribution of each of the variables, the researcher normally begins to investigate sets of relationships among two or more of these variables. This is

why chapter four of this study basically concentrates on frequency distribution and cross-tabulations. A "cross tabulation" is given as a joint frequency distribution of cases according to two or more classificatory variables, the display of the distribution of cases by their position on two or more variables is the chief component of contigency table analysis and is indeed the most commonly used analytic method in the social sciences (Nie, H. N., 1975). Thus, this provides a case for use of cross-tabulation and frequency analysis in this study. In chapter four of this study crosstabulations were done for various variables and tables were produced showing the frequencies and percentage distribution of the variables per district. Tables of mortality rates were also computed and produced.

3.3 REGRESSION ANALYSIS

Regression analysis, with all its variants, is the most common technique used to analyse the relationship between childhood mortality and socio-economic and demographic variables, whether with individual (Micro) data or with aggregate (Macro) data. The analysis of childhood mortality is faced with a complex multivariate system in which variables are likely to be interdependent. Furthermore, the analysis of Infant and Child Mortality is faced with a problem with multiple aspects (Berg, 1973; Chen, 1974). This method (although not the only one) of analysis was chosen because this study considers the differential importance of a number of macro-level factors for determining the level and risk

of infant and child mortality. Here an attempt is made to determine the relative importance of key variables as differentials in the level of Infant and Child Mortality in Kenya. The idea of using multivariate regression analysis has made it possible to determine to what extent demographic characteristics of the mother, household amenities; feeding practices, and morbidity patterns along with the prevalence of stunting (level of nutritional status) are significant predictors of mortality when they are considered separately and in combination with each other.

It can further be noted that bivariate associations will not give the separate contributions of specific determining factors. Multivariate analysis of the relationship between environmental factors and child mortality are undertaken here to determine, for instance, the extent to which a factor like distance to water source or sewage facilities influences the risk of Infant and Child Mortality at a given level of nutritional status.

3.3.I SIMPLE REGRESSION ANALYSIS

Regression analysis is concerned with relationship between variables and the contribution of different variables to the overall variability observed in the dependent variable (Ferguson, 1976). The Linear Model assumes that the explanatory or independent variables or predictor (s) (x) affects the dependent variable (y) in a systematic way that is distorted by more or less random scatter or disturbances. That is to say the observed trend of the data would have been perfect if there were no disturbances. In

simple regression analysis it is assumed that the variability in a dependent variable is accounted for partly by a single explanatory variable and partly by a disturbance or error term that might result from the data or partly by the effect of unconsidered variables. In effect this study if necessary will utilize a simple regression model to predict a dependent variable (mortality) from only one independent variable while other variables are held constant. In essence simple regression here will be used to measure the existence of a linear relationship between Child and Infant Mortality and a single socio-economic or demographic variable. Such a simple regression is of the form:-

$$Y = a + b\,x + e$$

where Y is the mortality variable, x is the socio-economic or demographic one and e is a random error term, with mean equal to zero. The two parameters of the regression equation a and b, indicate the form of the relationship between Y and x but say nothing about the accuracy of the estimates of Y that are given by the regression line. For this an associated parameter, the correlation - coefficient which measures the degree of association between the variables is used. The theoretical problems introduced by the use of the ordinary least-squares estimates are, of course, the assumptions that the relationship is linear in the coefficients, and that the error terms are independent of the socio-economic and demographic variables and of each other and that they have the same variance. The interest lies in the value of the coefficient b and its level of significance as well as in the correlation coefficient

the square of which is identical with the coefficient of determination. The correlation coefficient symbolised by 'p' relates the variance in the dependent variable Y to the reduction in that variance when the independent variable, x, is used to estimate values of Y. This coefficient is of paramount importance and therefore, it was found necessary to use it in this study. Further, it is assumed that the error term is normally distributed, the significance of the coefficient b is measured by the ratio between its value and the value of its standard error: the higher the ratio, the greater the confidence that can be placed in the existence of the linear relationship.

The closeness of the linear dependence between the two variables is measured by the correlation coefficient: the closer the correlation coefficient to 1, the closer is the apparent dependence.

This coefficient, thus, is arrived at by finding the ratio between the explained or reduced variance and the original variance. Here Explained variance = Original variance - Residual r. The original variance is known as the coefficient of determination (as already indicated). Finally the coefficient is arrived at by calculating the square root of the aforegoing ratio and that the square root is the correlation coefficient of Y on x.

one limitation to this technique (simple regression) is that mortality is related to more than one variable which means that single regressions can be used between mortality and a succession of other socio-economic and demographic variables each at a time and then ranking them in order of their coefficients. Factors may

themselves be related and a better method is needed which will consider all factors simultaneously. This is usually because a group of interrelated variables have to be considered in order to explain fully the variability in the dependent variable. This calls for the use of a multiple regression model which attempts to explain or predict a dependent variable from many independent variables.

3.3.2 MULTIPLE REGRESSION ANALYSIS

Multiple regression is a "general" statistical technique through which one can analyse the relationship between a dependent or criterion variable and a set of independent or predictor variables. Multiple regression may be viewed either as a 'descriptive' tool by which the linear dependence of one variable on others is summarized and decomposed, or as an 'inferential' tool by which the relationship in the population are evaluated from the examination of sample data. Although these two aspects of the statistical technique are closely related, it is convenient to treat each separately, at least on a conceptual level. The method (as a descriptive tool or inferential tool) can be used for a variety of related purposes. The most important use of the technique as a descriptive tool are: firstly to find the best linear prediction equation and evaluate its prediction accuracy. Secondly to control for other confounding factors in order to evaluate the contribution of a specific variable or set of variables and lastly to find structural relations and provide

explanations for seemingly complex multivariate relationships.

Through multiple regression techniques, a prediction equation that indicates poor scores on the independent variables could be weighed and summed to obtain the best possible prediction of the dependent variables for the sample, could be obtained. They could also obtain statistics that indicate how accurate the prediction equation is and how much of the variation in the dependent variable is accounted for by the joint linear influences of the independent variables. The research would also, 'simplyfy' the prediction accuracy, once certain other independent variables are included. The main focus of the analysis is, however, the evaluation and measurement of 'overall' dependence of a variable on a set of other variables.

Instead of focusing on prediction of the dependent variable and its overall dependence on a set of independent variables, the researcher may concentrate on the examination of the relationship between the dependent variable and a particular independent variable. The researcher may also wish to examine the impact of one independent variable confounded with another while controlling for variation in the interrelated independent variables and thus would use multiple regression to get a variety of 'partial coefficients'. Emphasis in this case is on examination of particular relationships within a multivariate context.

Another application of multiple regression as a descriptive tool is the use of multiple regression techniques in conjuction with causal theory. The emphasis of such an application is neither on

the overall dependence of one variable on another nor the relationship between any particular pair of variables. Rather, multiple regression is used to describe the entire structure of linkages between independent and dependent variables and to assess the logical consequences of a structural model that is posited a priori from some theory.

Various studies have attempted to relate environmental factors and mortality but have only been considering relationship between one single or composite determining variable (predictor) and the dependent variable (criterion). These studies include mainly those done by Cook (1969), Puffer and Serrano (1973); Ashford, et al. (1973); Collins, et al., (1971); Kelly and Munnan (1974); Fuchs (1974) and Cohen (1975); Shah and Abbey (1971); Fraser (1972); Weisbroad, et al., (1973), Brooks (1975); Anker and Knowles (1976) and Kune (1979). Some of these studies have applied multivariate analyses of the relationship between environmental factors and childhood mortality and morbidity.

As already indicated above, multiple regression is used to measure the existence of a relationship, linear in the coefficients, between the dependent variable and a number of independent variables. A linear multiple regression is of the form:

$$Y = a + b_1X_1 + b_2X_2 + b_3 X_3 + ... + b_kX_k + e$$

where Y = dependent variable
a = intercept
b = slope
$X_1, X_2 \ldots X_k$ = independent variables
e = error term

This method or technique tries to fit the observed data into a multiple linear regression model, including in the model, a number of independent variables measuring the impact of this set of variables in explaining the total variation in the dependent variable. Thus, the aim of the regression model is to select the particular straight line that best fits through a scatter of points, to provide the best description of the trend in that scatter and the best set of estimates of Y_i from X_i. The regression analysis measures the goodness of fit of the data. Here the correlation coefficient measures the degree of association between the variables. The correlation in the bivariate analysis (simple regression) is symbolised by r in simple correlations or R in multiple correlation. All correlation coefficients range from -1 to +1. It indicates that a higher correlation exists, while values equal to zero indicate absence of correlation. If the values of correlation (r or R) are squared, they show what percentages of variability in the dependent variable is explained by the independent variable(s).

However, on the whole, this study has made limited application of the following assumptions of the regression model:-

1. Regression analysis fits a straight line trend (line of best fit) through a scatter of data points and correlation analysis tests for the goodness of fit of this line. Clearly if the trend cannot be repeated by a straight line, regression analysis will not portray it accurately. But in cases it can be made by transforming the data by the use of logarithm among other methods.

2. Normality - the observations must be at least twenty or more. This is in order to allow for a large number of degrees of freedom in testing the statistical significance of each independent variable. Normality is considered, because it is widely assumed that use of the linear regression model required that the data have a normal distribution. This requirement does not mainly have to be restricted to the raw data which need not be normally distributed, it is that the condition distribution of the residuals are normal.

3. The data used need not be random or normally distributed.

4. The mean disturbance or error term 'e' is zero. That is to say that the error term 'e' is uncorrelated with the independent variable(x) X. This means that there is no systematic association between positive or negative disturbances of high or low values of the independent variable(s)

5. Homoscedasticity, i.e., the assumption that the disturbance terms have the same variance. This means that for each independent variable, there is a conditional distribution for the values of the dependent variable and that this distribution is constant all over the linear relationship.

6. The independent variables should not be strongly interrelated.

3.3.3 LIMITATIONS OF MULTIPLE REGRESSION ANALYSIS

1. If a large number of variables are included in the regression equation, the smaller the chances for the coefficents to be

significant, because many independent variables are related to each other, thus, bringing the problem of multicollinearity (to be discussed later in this chapter). This can be solved by trying out several combinations of multiple regressions, each of them with few variables so that those with significant coefficients can be retained, or use of the stepwise method where the partial correlation coefficients for each variable is computed, and then the others are introduced one by one in the order of decreasing partial correlation, when the coefficient of determination becomes negligible , no new variable should be introduced.

2. Secondly, this technique establishes relationships directly or indirectly between variables but does not establish causality.

3. It also assumes that no significant variables have been left out of the equation.

4. Other limitations can be seen in the form of objections raised against the use of Ordinary Least Squares (OLS) methods to estimate parameters of the linear regression model. These objections are that:-

   (a) It can yield probabilities outside the 0 - 1 interval.

   (b) The true probability relationship is more likely to be S-shaped than linear, approaching values of zero and one asymptotically.

5. However, on the whole, the most serious problem in most statistical analysis is the lack of reliability of data. The degree of sophistication of this statistics model may be reduced by the fact that mortality data (especially survey

data) in Kenya is still far from satisfactory. Hence it is necessary that one remains cautious when interpreting statistical results from the present study.

3.3.4 MULTICOLLINEARITY

Is defined as the intercorrelation of the independent variables. Multicollinearity arises when the independent variables overlap and thus this can reduce the reliability of their individual influences and effect on the dependent variable as should be measured by the regression coefficient. Multicollinearity can cause problems with respect to the following interrelated aspects of regression analysis.

1. If at least one of the independent variables in the equation, the coefficients may not be uniquely determined. Perfect collinearity would lead to the problem of a zero divisor. If extreme collinearity exists (intercorrelations in the 0.8 to 1.0 range), it may not be possible to invert the correlation matrix of the independent variables.
2. Estimates of the regression coefficient from sample to sample fluctuate markedly.
3. One of the uses of multiple regression as an interpretive tool is to evaluate the relative importance of the independent variables. The situation is somewhat paradoxical. The more strongly correlated the independent variables are (excluding of course, extreme multicollinearity which prevents the coefficients from being calculated at all), the greater the need for controlling the confounding effects. However, the

greater the intercorrelation of the independent variables, the less the reliability of the relative importance indicated by the partial regression coefficients.

When extreme multicollinearity exists there is no acceptable way to perform regression analysis using the given set of variables. Two suggested solutions are:

i. To create a new variable which is a composite scale of the set of highly intercorrelated variables and use the new scale variable in the regression equation in place of its components, or

ii. Use only one of the variables in the highly correlated set to represent the common underlying dimension.

3.4.I TESTING OF STATISTICAL SIGNIFICANCE

The significance of a multiple correlation may be tested by calculating a variation ratic (F). This is defined as the ratio of predicted variance to non-predicted variance. The predicted variance has degrees of freedom r and non-predicted variance has n - r - 1 degrees of freedom. The variance rates, F, is therefore of the form:

$$F_r^{n-r-1} = \frac{R^2}{r} \Big/ \frac{1-R^2}{n-r-1}$$

The F-distribution is used for testing the equality of two estimated variances. This problem frequently occurs when two variances are independently estimated and one wishes to test whether they are equal or not. Thus the F-test suggests that there exists a relationship between multivariate analysis of variance and multiple regression methods. The F-test is the one mostly used in this study.

3.5.0 MEANING OF REGRESSION COEFFICIENTS

The correlation coeffients are the measures of the regression of the criterion "Y" on the predictor variables (X's). They also measure the degree of correlation between the criterion (dependent) and the predictors (independent variables). The coefficient Y/X is given by:-

$$r_{yx} = \frac{\frac{1}{n}\sum_{i=1}^{27}(Y_i - \bar{Y})\sum_{r=1}^{19}(X_r - \bar{X})}{\sqrt{\frac{1}{n}\sum_{i=1}^{27}(Y_1 - \bar{Y})^2 \frac{1}{n}\sum_{r=1}^{19}(X_r - \bar{X})^2}}$$

If there exists an exact linear relationship between the variable $r_{yx} = +1$ and the variables increase simultaneously, and $r_{yx} = -1$ when one variable increases and the other decreases. These are the two extreme cases. In general, r_{yx} can be positive or negative with values lying between 0 and 1. The signs and the relative magnitudes of the regression coefficients also indicate the nature and extent to which each of the determinants of mortality affect the level of mortality.

Other statistics concepts encountered in this analysis include those in simple regression analysis, where values of the dependent variable are predicted from a linear function of the form:

$$Y^1 = A + BX$$

Where Y^1 is the estimated value of the dependent variable, Y, B is a constant by which all values of the independent variable X

are multiplied, and A is a constant which is added to each case.

The difference between the actual and the estimated value of Y for each case is called the 'residual' i.e. the error in prediction, and may be represented by the expression:-

$$\text{Residuals} = Y - Y^1$$

The regression strategy involves the selection of A and B in such a way that the sum of the squared residuals is smaller than any possible alternative values. Expressed in another way,

$$\sum (Y - Y^1)^2 \quad SS_{res} = \text{Minimum}$$

It can be shown that the optimum values for B and A are obtained from the following formulas:

$$B = \frac{\sum (X - \bar{X})(Y - \bar{Y})}{\sum (X - \bar{X})^2} = \frac{SP_{xy}}{SS_x}$$

$$A = \bar{Y} - B\bar{X}$$

Where SP_{xy} is our symbolic notation for the sum of cross product of X and Y and SS_x denotes the sum of squares of X.

The B and A coefficients are a symmetrical since X has been taken as the predictor of Y. Their values will not, in general equal those obtained when Y is used as a predictor of X.

The constant A, referred to as the Y 'intercept', is the point at which the regression line crosses the Y axis and represents the predicted value of Y when X=0. The constant B, usually referred to as the nonstandardized regression coefficient, is the slope of the regression line and indicates the expected 'change' in Y with a 'change' of the unit in X (i.e. it indicates

two groups that happen to be different on X by one unit). The predicted Y^1 values fall along the regression line, and the vertical distances $(Y - Y^1)$ of the points from the line regression (regression line) represent residuals (or errors in prediction). Since the sum of squared residuals is minimized, the regression line is called the 'least-squares line' or the 'line of best fit'. In other words there is no other line which is "closer" to the points, i.e. for other line is $(Y - Y^1)^2$ smaller.

As already indicated, in this study both simple and multiple regressions are used in analysing the data. In order to test whether the relationships were spurious or not, F-test is used and this is tested at various levels of significance. Since the author is dealing with a large number of observations, it is found necessary to use computer facilities. Hence, SPSS (Statistical Package for Social Sciences) is used to run the regressions and correlations. However, a few practical problems were experienced by the researcher while using the regression model. The major problem encountered was multicollinearity. This problem was solved by dropping some variables from the regression equation and by running separate regressions for groups of variables, for instance running a separate regression equation for household amenities' variables, feeding pattern variables, morbidity variables or maternal variables. In all this, the author was encouraged to use the regression model especially when it was observed that several scholars have used it in the analysis of mortality.

In this chapter, the methodology used in the analysis is discussed. To select the most suitable methods a number of available methods of data analysis were examined and the ones considered were found to be the best suited to the topic under study. The next two chapters discuss the data and the results obtained from this methodology.

It should, however be noted that while regression analysis has been applied in this study no claim is made on meeting all the regression analysis and as such more emphasis has been made on bivariate relationships.

CHAPTER IV

4.1. INTRODUCTION

This chapter deals with the interpretation of data and centres mainly on a descriptive statistical analysis. The descriptive analysis will involve district level description of household amenities, feeding practices, demographic characteristics of the mother and morbidity patterns. The descriptive analysis will also touch on the provincial and district level profiles so as to give a clear picture of differential mortality and the interplay of various factors in each province and district. The interrelationships among the independent variables are analysed and carried out to foster appropriate deductions to be made on the dependent-independent variables' associations.

4..2. DISCUSSION OF THE INDEPENDENT VARIABLES AT PROVINCIAL AND DISTRICT LEVEL

The prevalences and means of nutritional status indicators by Provincial and District are presented in Table AI below. At Provincial level, Coast Province has by far the highest level of stunted children (36.2%), followed by Nyanza, Western and Eastern Provinces. Central and Rift Valley Provinces have the lowest, with similar prevalences of stunting. Other health and social indicators thought to be possibly related to nutritional status are also presented in Table AI below. The health indicators, for instance mortality data, i.e. Infant and Child

TABLE AI

INDICATORS OF NUTRITIONAL STATUS AND OTHER SELECTED SOCIO-ECONOMIC INDICATORS BY DISTRICT AND PROVINCE

	% STUNTED	CHILD MORTALITY RATE (x1000)	% SICK	MALARIA % CASES	% CHILDREN WITH MOTHERS HAVING NO EDUCATION	% WITHOUT PIPED WATER	% WITHOUT SEWAGE FACILITIES	CHILD POPULATION 0-4 YEARS (x1000)	NO. CHILDREN STUNTED (x1000 (STUNTATION RATE)
NATIONAL	24.0	105	46.5	19.1	48.6	88.2	33.5	2597	625
COAST	36.2	160	54.3	24.5	77.4	79.3	61.9	184	68
KILIFI/TANA RIVER LAMU	42.1	157	64.1	25.8	85.8	74.7	64.9	105	44
KWALE	38.5	194	43.4	23.8	83.0	86.0	81.5	53	20
TAITA TAVETA	14.7	101	46.4	23.9	40.9	80.5	14.7	26	4
EASTERN	22.6	82	43.4	19.3	45.9	88.2	37.6	483	107
MACHAKOS	23.1	79	46.9	19.6	38.3	95.3	36.8	189	44
KITUI	30.0	102	37.4	25.0	70.9	100.0	72.1	83	25
MERU	16.8	73	41.0	15.7	43.9	68.4	14.1	160	27
EMBU	22.3	88	45.0	16.7	34.9	89.1	19.3	51	11
CENTRAL	20.4	65	37.1	6.7	30.3	77.3	1.7	439	88
NYERI	18.5	32	44.9	1.4	13.4	78.6	0	87	16
MURANGA	24.8	73	42.1	11.3	28.1	76.2	2.8	127	31

	% STUNTED	CHILD MORTALITY RATE (x1000)	% SICK	MALARIA % CASES	% CHILDREN WITH MOTHERS HAVING NO EDUCATION	% WITHOUT PIPED WATER	% WITHOUT SEWAGE FACILITIES	CHILD POPULATION 0-4 YEARS x1000	NO. CHILDREN STUNTED x1000 STUNTATION RATE
KIRINYAGA	24.5	79	35.3	14.4	43.3	77.7	4.1	53	13
KIAMBU	17.5	77	30.6	4.5	40.1	75.0	0	125	22
NYANDARUA	12.4	55	25.4	1.7	35.2	82.4	2.0	47	6
RIFT VALLEY	19.8	92	39.1	15.2	55.1	88.7	49.6	637	132
NAKURU	34.5	82	43.6	9.2	54.9	85.8	14.3	101	35
NANDI	12.1	98	48.1	13.8	46.1	79.6	53.1	58	7
NAROK/KAJIADO	19.8	49	32.1	15.8	72.6	93.2	79.2	90	18
KERICHO	18.1	72	28.4	14.9	64.8	85.7	66.4	128	23
UASIN GICHU	17.8	99	24.7	19.8	41.6	95.2	48.5	57	10
TRANS NZOIA	19.1	121	41.8	17.5	44.5	86.8	25.3	53	10
BARINGO/LAIKIPIA	19.4	127	47.7	12.2	55.4	93.0	41.7	80	16
EL. MARAKWET/W.POKOT	18.6	116	49.3	18.6	53.8	98.1	54.5	70	13
NYANZA	28.6	135	58.8	30.0	51.6	97.5	37.8	492	140
SOUTH NYANZA	25.3	161	58.4	31.6	56.9	99.5	68.8	145	37
KISII	33.1	95	57.7	20.9	51.9	99.0	17.4	180	56
KISUMU	19.8	200	60.7	34.7	36.5	87.5	7.8	86	17
SIAYA	36.6	204	61.1	32.6	51.5	98.1	36.1	81	30
WESTERN	25.7	148	56.8	29.7	46.3	95.5	19.4	362	91
KAKAMEGA	26.7	140	56.2	31.0	46.2	96.5	16.4	201	54
BUNGOMA	24.7	98	49.6	30.4	35.1	89.3	25.2	105	25
BUSIA	21.1	175	72.6	27.6	88.4	99.3	26.6	56	12

Mortality rates, and the morbidity rates, appear to follow most closely the district and provincial rankings of the nutritional indicators. The ranking are presented in Table A2 below. Although the rankings of the health indicators are not identical among themselves, or with those of per cent stunted children, they divide the provinces into two groups. Coast, Nyanza and Western Provinces show high levels of stunting, mortality and morbidity than Eastern, Central and Rift Valley Provinces. Both education and sewage facility indicators show similar rankings to those of nutritional stunting with the exception in both cases of Rift Valley Province which has the best nutritional status but shows the second highest percent of children with mothers having no education (55.1%) and also the second highest percent of children living in households with no sewage facilities (49.6%). Percent children living in households with no piped water also shows similar rankings to those of nutritional stunting with the exception of Coast Province, which has the highest level of stunting (36.2%) but the second highest percent with no piped water.

The aforegoing analysis has consequently shown that the high correlation between rankings of health indicators and nutritional stunting shows that the areas which have high disease rates also tend to have more nutritional problems and indicates that there is at least direct and indirect association between morbidity, mortality and nutritional problems. This shows that not only are such correlation that exist between indicators of interest, but the discords also provide important clues into potential causes of, and

TABLE A2

RANKINGS OF NUTRITIONAL AND OTHER SOCIO-ECONOMIC AFFECTING INFANT AND CHILD MORTALITY BY DISTRICT

DISTRICT	STUNTING	MORTALITY	% SICK	NO. EDUCATION	MALARIA RANK	NO. PIPED WATER	NO. SEWAGE FACILITIES
KILIFI/T.RIVER/LAMU	1	6	2	1	6	26	6
KWALE	2	3	17	2	10	16	1
TAITA TAVETA	25	12	13	19	9	20	19
MACHAKOS	12	19.5	12	21	13.5	8	11
KITUI	6	11	21	4	8	1	3
MERU	24	22.5	20	16	22	27	21
EMBU	13	17	14	25	17	13	16
NYERI	20	27	15	27	27	22	26.5
MURANGA	9	22.5	18	26	23	24	24
KIRINYAGA	11	19.5	22	17	20.5	23	23
KIAMBU	23	21	24	20	25	25	26.5
NYANDARUA	26	25	26	23	26	19	25
NAKURU	4	18	16	9	24	17	20
NANDI	27	14.5	10	14	20.5	21	8
NAROK/KAJIADO	15.5	26	23	3	15	10	2
KERICHO	21	24	25	6	19	18	5
UASIN GISHU	22	13	27	18	13.5	9	9
TRANS NZOIA	18	9	19	15	16	15	14
BARINGO/LAIKIPIA	17	8	11	8	18	11	10
EL. MARAKWET/W. POKOT	19	10	9	10	11	5.5	7
SOUTH NYANZA	8	5	5	7	3	2	4

TABLE A2 CONTINUED

DISTRICT	STUNTING	MORTALITY	% SICK	NO. EDUCATION	MALARIA RANK	NO PIPED WATER	NO SEWAGE FACILITIES
KISII	5	16	5	11	12	4	17
KISUMU	15.5	2	3	22	1	14	22
SIAYA	3	1	4	12	2	5.5	15
KAKAMEGA	7	7	7	13	4	7	18
BUNGOMA	10	14.5	8	24	5	12	15
BUSIA	14	4	1	5	7	3	13

targeting for nutritional and mortality problems. The percentage of children having mothers with no education and high percentage of children living in households with no sewage facilities in Rift Valley Province, which has the lowest level of stunting among the provinces, indicate that at least in Rift Valley the interrelationships of nutritional status with environmental and social indicators may be very complex.

The district level estimates plus other relevant health and social indicators are presented in Table A1 as the provincial estimates in order of descending prevalence of stuntings. It should also be noted that the rankings have been made in descending order, so that rank one indicates the highest level of prevalence of stunting.

One outcome of these tabulations in the identification of those districts as target areas which show the greatest nutritional problems and consequently highest levels of Infant and Child Mortality. For purposes of targeting two criteria should be considered i.e. the prevalence of malnutrition, and the total number of malnourished children in the area. In practice, decisions tend to be based partly on both considerations, and fortunately the priority ranking for those data are quite similar on either basis. Based on the criterion of total number of children affected, the following eight districts are ranked in order of decreasing priority: Kilifi/Tana River/Lamu; Kisii, Machakos, South Nyanza, Kwale, and Kitui districts, Kakamega, Nakuru, Muranga and Siaya districts should be added to this list, since they have high prevalences of malnutrition although lower

numbers of malnourished children because of their small populations. More than half (54%) of the estimated total number of stunted children come from 30% of the district sampling areas, i.e. in the first eight areas listed above. This means that there is substantial potential for increased efficiency in providing services and other inputs to the malnourished by concentrating on these eight districts.

Coast, Nyanza, and Western Provinces are noted above to have the highest levels of nutritional stunting and mortality. Kilifi/Tana River/Lamu and Kwale are the main contributors to the high level of mortality and stunting in Coast Province. The third area in Coast i.e. Taita Taveta in contrast to the rest of the Province ranks 25th and 12th of the districts in prevalence of stunting and mortality without Taita Taveta the prevalence of stunting and mortality in Coast Province would have been even higher. In Nyanza Province, Siaya, Kisii and South Nyanza are among those districts identified as high priority (in terms of nutritional intervention programmes); only Kisumu is not a high priority district. Therefore, half of the priority districts come from Coast and Nyanza Provinces alone. From Western Province, which has the third highest prevalence of stunting, (25.7%) and second highest levels of mortality (148 per 1000) among the remaining Provinces. Eastern Province has two districts, Kitui and Machakos, which are identified as high priority, Central Province has one district, Muranga; and Rift Valley has one also, Nakuru district.

The districts with the highest prevalence of malnutrition tend to be located in the western part of Kenya or bordering the Coast. Prevalences are mapped in three categories in Table A2 above. The ranking of districts by prevalence of stunting and mortality shows consistency between nutritional status and the other indicators shown in Table A1. Generally, higher prevalences of malnutrition by district are associated with higher rates of mortality and morbidity, and with a greater percent of children with uneducated mothers. The relationship of nutritional status to Infant and Child Mortality, as shown in Table A1 is striking. At the district level, mortality is closely associated with nutritional status where the sickness rates are average or below average, but the relationship is less strong in areas of high morbidity, i.e. South Nyanza, Busia and Kisumu districts, (see Table A1.). Malaria is clearly important, where areas with high prevalences of malnutrition overlap, substantially with those where malaria is widespread. This would have been the case, as malaria is likely to affect the food-intake of the child and mother and thus leading to their being malnourished. Another explanation could be given from the point of view of weather conditions where malaria is prevalent. Malaria is usually prevalent in hot-dry areas where food production is not adequate.

The level of education (mother's education level) discriminates well between districts with higher and lower prevalences of malnutrition and levels of Infant and Child Mortality. Whether education itself is the important factor or

whether it is reflecting other aspects of socio-economic status cannot be distinguished from present data, as the education indicator is correlated with the indicators of access to sewage and distance to water source.

Among the districts with high levels of Child and Infant Mortality and high prevalences of malnutrition there seems to be two groups which account for the majority of the high priority districts (interms of nutritional and health intervention programmes). High morbidity and poor education are consistently associated with malnutrition in some areas, i.e. the districts in the west and possibly parts of central province. The second group of districts consists of areas such as Kwale and Kitui where sickness rates are about average but education and other indicators are low, e.g. water availability and sewage facilities. Overall, there are probable explanations for many of the district rankings in terms of a number of effects: incidence of sickness, notably, educational levels etc.

As an illustration of the above points, the characteristics of the worst affected districts and certain least affected districts are discussed.

The three sample districts from Coast Province (i.e. Kilifi/Tana River/Lamu, Kwale), have the highest level of stunting at almost twice the national average (24.0%) with equally high levels of Infant and Child Mortality. Kilifi/Tana River/Lamu contributes the greatest number of malnourished children of any sampling stratum. Although the sampling unit covered three districts, the greatest number of children come

from Kilifi district. The Kilifi/Lamu/Tana River area has a high rate of sickness at 64%, associated with a high incidence of malaria and a very high proportion of uneducated mothers (85.8%). Kwale has a much lower population of preschoolers, but has the second highest prevalence of stunting, an extremely high mortality rate, and although a lower morbidity rate than Kilifi, an equally high proportion of uneducated mothers (85.8%). Problems in these districts may be substantially related to low agricultural production in the arid coastal areas, a climate which tends to foster more diseases and low levels of development. Top priority (health and nutritional intervention programmes) should be given to the Kilifi/Tana River/Lamu area, which has both the highest prevalence of malnutrition, and the highest total number of malnourished children.

The second category of districts include Siaya, Kisii, Kakamega, South Nyanza, and Busia; all these districts are located in the west, in Nyanza and Western Provinces. Busia district is included here because although the prevalence of stunting is not extremely high, its level of child mortality rate (175/1000) is one of the highest. Busia also has other characteristics in common with this group of districts. The four other districts all have high prevalence of malnutrition between 25 and 31%, and also rank high in having a large number of stunted children. These districts fall into the same category on the basis of low levels of education, and high sickness rates including malaria. The child mortality rates are among

the highest in the country, with Siaya having 204 per 1000, Kisii 95/1000, Kakamega 140/1000, South Nyanza 161/1000 and Busia 175/1000. Major nutritional problems in these districts are likely to be related to all of these factors.

Another category of high priority districts include Kitui and Machakos which are located in Eastern Province, with 23 and 30% prevalence of stunting, respectively, with child mortality rates of 102/1000 for Kitui and 79/1000 for Machakos. Whereas Kitui has fewer stunted children overall than Machakos, it ranks high in terms of the prevalence of stunting, and other indicators, especially mortality, access to water and sewage facilities, and educational level. Machakos, on the other hand, does not show high rankings in any of the indicators except lack of piped water and lack of sewage facilities and in fact has fairly good educational levels of the mother. Concern over Machakos lies in its large population of pre-school children.

In consideration of other high priority districts, we have Nakuru and Muranga. In both of the districts the estimates of nutritional stunting are higher than might have been expected. The results from these districts need to be examined more closely and the discussion below should be considered tentative. Nakuru ranks fourth in prevalence of stunting, yet is located in Rift Valley Province which has the lowest rate of malnutrition of all provinces. All the other indicators are not consistent with the high level of stunting, mortality and sickness rates are average to low and 55.9% (about half) of the mothers are uneducated. One possible explanation for poor nutritional status, would be that cooperatives in this area

are contributing to the production in producing of small landholdings and concentration of cash crops and thus reduce production of food crops and livestock. Muranga district is also included tentatively as a priority district because of the high number of stunted children (24.8%). However, Muranga is located in Central Province which is the best province in terms of most indicators and second to Rift Valley in nutritional status. The child mortality rate in Muranga is the lowest (73/1000) of all the priority districts, the morbidity rate is low, and 28.3% of the children had mothers who were uneducated. On the whole, however, Muranga is contigious with Machakos and close to Embu, both of which have somewhat higher than average prevalences of malnutrition. It may be that this situation extends to Muranga. One possible explanation might be that Muranga is a large coffee growing area, and most farmers do not own their own land but work elsewhere for very low wages, and that those with their own land might cultivate their land only for generation of cash which more often than not finds its way to purchase of food or other consumer items.

In terms of low priority districts, Nandi, Nyandarua, Kiambu and Meru are the districts which show markedly better levels of nutritional status, mortality levels and standards of living, reflected by the indicators examined (see Table AI). These are among the districts least affected by malnutrition. All other indicators (as listed in Table AI), also reflected this better environment. Nyandarua, Kiambu and Meru districts have extremely low mortality and correspondingly

lower than average rates of sickness (here average rate refer to a sickness rate of about 50%). Nutrition in Nandi is better than expected, given the mortality data and other indicators. The higher mortality and sickness rates concomitant with the lower level of stunting in Nandi could have resulted from the level of economic development which has been rapid in recent years. Nandi and Nyandarua districts have the fewest numbers of 0-4 years old (shown in Table A1) affected by malnutrition. Meru district ranks well-off (24th) in terms of prevalence of stunting as well as other indicators, however, its large population means that a substantial proportion of the total malnourished come from this area.

The last category of low priority districts include Kericho and Uasin Gishu which are similar in terms of certain characteristics examined. The prevalence of stunting in both areas is about 18%, mortality is below average at about 90 per 1000 births, and rates of sickness are average at 28.4 and 24.7%, respectively. The only difference between these districts is in the educational level of mothers, which shows 50% more educated mothers, in Kericho (66.1%) than in Uasin Gishu (40.1%). Income in Kericho however, is likely to be higher due to the extensive cultivation of tea, which may account for better nutrition in thisarea than might have been expected. This cash is unlike that of Muranga district where income accrues mainly from intensive cultivation of coffee, income from coffee also takes longer than that from tea which is usually on a monthly basis. Incomes from the tea plantations benefit individual households, given that most of the tea workers receive monthly wages which can be used for the purchase of food and other consumer items.

In summary, despite some inconsistences between nutritional status, mortality, sickness and education, the general trend shows that a higher standard of living as measured by the indicators examined, is associated with better nutritional status. Detailed comparisons of districts with levels of stunting and mortality and those with low levels can provide insights into which factors must be given priority for intervention (nutritional, child and maternal health) programmes. A regression analysis of these factors is done in chapter 5 of this work so as to classify these factors. For example, Kilifi, Siaya and South Nyanza show high rates of mortality and sickness, likely due to malaria, thus measures to eradicate malaria in these areas might greatly improve nutritional status and thus Infant and Child Mortality levels.

4.3 DESCRIPTION OF DISTRICT LEVEL FACTORS AFFECTING NUTRITIONAL STATUS AND INFANT-CHILD MORTALITY

This section presents the differentials in nutritional status and Infant and Child Mortality in the context of four different categories of independent variables which are thought to affect the nutritional status of children under age five and consequently the level of mortality experience. These variables include household amenities, the demographic characteristics of the mother, the child's feeding pattern, the morbidity experience of the child. Here district level information concerning these variables is presented in Tables B1 and B2.

In this section, a discussion of the possible relationship between the various independent variables and nutritional status along with Infant and Child Mortality is carried out. For most of the relationships investigated, percent of children stunted, defined as less than 90% of the median standard height-for-age, is used as the outcome variables (sometimes referred to as the dependent variable). Thus, stunting is used as a measure of nutritional status of the child as already mentioned in the definition of variables). The reason for this choice is two fold. First, stunting is thought to represent a long term nutritional problem, and second, most of the relationships investigated represent chronic environmental or intrahousehold situations.

4.3.1. DEMOGRAPHIC CHARACTERISTICS OF THE MOTHER

The demographic characteristics of the mother discussed or applied in this section include marital status, educational level and age. Here, these maternal factors are investigated as to determine their role in mortality differentials in Kenya's districts, and the prevalence of stunting in the country. It is argued in this case that, nutritional status as measured from the level and prevalence of stunting will reflect the risk of Infant and Child Mortality. This section will only give a descriptive analysis by use of frequencies and crosstabulations of the demographic characteristics of the mother. These are given in Tables B1 and B2.

TABLE B.1

FREQUENCIES OF DEMOGRAPHIC CHARACTERISTICS OF THE MOTHER BY PROVINCE AND DISTRICT

	MATERNAL FACTORS								
	MARITAL STATUS			EDUCATION					
	% MARRIED	% WIDOWED	% SINGLE SEPARATE DIVORCED	% NONE	% STD 1-4	% STD 5-8	% SEC	% UNIVER. COLLEGE	% PRIMARY
NATIONAL	89.9	2.4	7.7	49.4	20,0	23.8	5.5	1.3	43.8
COAST	87.4	4.3	8.2	69.8	10.6	12.8	2.6	4.2	23.4
KILIFI/TANA RIV./LAMU	91.8	4.6	3.6	85.8	5.6	3.6	1.0	4.1	9.2
KWALE	89.2	4.1	6.7	82.8	9.0	3.2	1.6	3.3	12.2
TAITA TAVETA	81.3	4.1	14.4	40.9	17.1	31.6	5.2	5.2	48.7
EASTERN	87.9	2.3	7.5	46.8	20.1	26.2	6.9	0.6	45.8
MACHAKOS	88.2	3.1	8.8	38.3	21.4	36.6	4.9	0.8	56.0
KITUI	87.9	3.6	8.4	70.0	9.9	17.1	3.1	0	27.0
MERU	85.4	1.5	13.9	43.7	25.8	19.4	9.8	1.5	45.2
EMBU	90.1	1.0	8.9	35.1	23.3	31.7	9.9	0	55.0
CENTRAL	86.1	1.5	12.5	31.7	24.2	34.7	7.5	2.1	58.9
NYERI	79.0	0.6	20.4	13.2	23.4	46.1	14.4	3.0	69.5
MURANGA	91.7	2.8	5.5	28.3	31.5	35.7	1.8	2.7	67.2

TABLE B.I CONTINUED

KIRINYAGA	91.6	0.9	7.5	43.3	21.2	24.5	7.8	3.2	45.7
KIAMBU	79.2	1.3	19.5	40.3	19.4	32.4	7.9	0.6	51.8
NYANDARUA°	88.8	1.7	9.5	33.2	25.3	34.9	5.4	1.2	60.2
RIFT VALLEY	90.8	2.0	7.3	54.2	19.8	21.3	3.9	0.9	41.1
NAKURU	84.7	1.2	14.1	55.9	10.5	27.1	5.3	1.2	37.6
NANDI	91.1	2.7	6.2	45.5	25.3	20.6	7.8	0.8	45.9
NAROK/KAJIADO	94.9	0.5	4.5	72.7	7.6	14.7	4.5	0.5	22.3
KERICHO	97.9	0.5	1.6	66.1	12.4	18.3	2.2	1.1	30.7
UASIN GISHU	86.3	3.6	10.2	40.1	27.5	30.5	2.0	0	58.0
TRANS NZOIA	92.1	2.3	5.6	45.1	26.5	23.3	4.2	0.9	49.8
BARINGO/LAIKIPIA	87.5	4.8	7.8	54.7	20.0	21.8	1.2	2.4	41.8
EL MARAKWET/W. POKOT	91.8	0	8.2	53.1	28.9	13.9	4.1	0	42.8
NYANZA	92.6	4.4	3.0	49.0	22.2	22.7	5.6	0.3	45.0
SOUTH NYANZA	95.6	4.4	0	57.1	18.7	19.7	4.5	0	38.4
KISII	91.4	3.8	4.8	51.1	20.4	22.6	4.9	0	43.0
KISUMU	91.9	4.7	3.4	37.2	29.7	27.7	5.4	0	57.4
SIAYA	91.4	4.8	3.9	50.5	20.0	20.9	7.7	1.0	40.9
WESTERN	95.1	1.0	3.9	50.0	19.9	21.9	7.4	0.9	41.8
KAKAMEGA	93.7	1.6	4.8	46.5	23.2	22.0	7.5	0.8	45.2
BUNGOMA	97.9	0	2.1	34.6	24.6	29.9	10.5	0.5	54.5
BUSIA	93.7	1.4	4.9	69.0	11.8	13.8	4.1	1.4	25.6

TABLE B2

FREQUENCIES OF DEMOGRAPHIC CHARACTERISTICS OF THE MOTHER BY PROVINCE AND DISTRICT (CONTINUED)

	AGE OF MOTHER							
	MEAN AGE OF MOTHER	% AGE 14-19	% AGE 20-24	% AGE 25-29	% AGE 30-34	% AGE 35-39	% AGE 40-44	% AGE 45+
NATIONAL	30.2	2.6	21.1	27.5	21.6	13.6	8.7	4.5
COAST	29.5	3.7	25.9	25.8	17.8	15.3	8.1	3.4
KILIFI/TANA RIV./LAMU	29.7	3.6	27.7	22.6	17.4	17.0	8.1	3.5
KWALE	29.5	3.7	26.3	27.6	13.8	15.1	8.9	4.5
TAITA TAVETA	29.3	3.8	23.7	27.3	22.1	13.7	7.4	2.2
EASTERN	31.0	2.7	22.5	22.5	20.6	12.6	11.9	7.1
MACHAKOS	31.8	3.0	16.8	23.9	23.7	10.4	15.3	7.1
KITUI	31.5	3.6	22.5	21.9	15.6	13.8	13.4	8.9
MERU	30.1	3.5	27.0	20.5	19.4	15.0	10.5	4.5
EMBU	30.8	0.5	23.7	24.3	23.7	11.5	8.5	8.0
CENTRAL	30.7	2.9	20.1	22.1	25.5	15.8	8.6	4.8
NYERI	29.4	4.9	26.9	18.0	25.5	15.5	5.5	3.1
MURANGA	31,6	2.4	12.8	25.1	27.8	16.0	11.8	4.3
KIRINYAGA	30.9	2.9	16.8	24.7	25.7	19.0	7.4	3.8

Table B 2 Continued

KIAMBU	31.0	0.6
NYANDARUA	30.8	3.7
RIFT VALLEY	30.0	2.1
NAKURU	29.9	1.8
NANDI	28.4	3.9
NAROK/KAJIADO	28.3	2.5
KERICHO	29.6	1.6
UASIN GISHU	31.7	2.0
TRANS NZOIA	30.2	1.9
BARINGO/LAIKIPIA	31.6	1.8
EL MARAKWET/W. POKOT	30.3	1.0
NYANZA	30.2	6.2
SOUTH NYANZA	28.6	9.4
KISII	31.3	2.1
KISUMU	29.4	4.1
SIAYA	31.5	2.9
WESTERN	29.7	2.4
KAKAMEGA	29.6	3.5
BUNGOMA	29.4	0
BUSIA	30.1	3.6

25.3	19.4	25.9	12.2	7.1	8.9
18.6	23.2	22.4	16.5	11.2	4.1
20.6	30.4	22.4	13.5	7.5	3.4
20.1	30.6	24.6	13.5	5.9	3.6
28.8	33.8	12.4	11.3	7.8	2.0
26.0	38.1	20.5	4.5	4.0	4.0
27.9	25.3	24.2	12.9	4.9	3.6
18.1	23.0	19.4	18.0	12.9	5.5
18.8	33.4	15.9	19.8	7.4	2.8
14.2	19.9	34.8	15.8	10.0	3.6
10.9	38.8	27.5	12.4	7.3	2.0
19.4	29.0	19.3	12.4	9.8	5.4
19.7	30.6	22.2	9.9	4.0	5.4
17.8	25.3	20.4	17.8	8.1	8.1
24.5	27.3	19.1	15.0	8.8	1.4
15.4	32.7	15.4	6.8	18.3	7.7
19.5	35.1	21.7	11.0	6.9	3.5
18.6	34.4	24.9	9.2	7.6	2.0
24.2	38.9	14.2	13.8	7.4	2.1
15.8	32.4	25.9	10.0	5.8	6.5

From the data, it can be noted that a majority of Kenya's women are married (89.9%) with only a small proportion widowed (2.4%) and 7.7% are either separated or divorced or single (unwed mothers). Provinciallly, Western Province shows the highest proportion of married women (95.1%) with Central, Eastern and Coast Provinces having the lowest proportions (See Tables B1 and B2). The rest of the other provinces have more or less the same proportions (averaging 90%). In terms of divorced and separated and widowed women, Central, Eastern and Coast Provinces exhibit the highest proportions of women in each category with the rest of the other provinces exhibiting more or less the same characteristics. Here, widowhood although a mortality outcome variable is not treated separately as it is being used as a measure of marital instability and its proportions in the data are extremely small.

At district levels, Kiambu, Nyeri, Taita Taveta, Meru and Nakuru indicate the highest proportions of widowed, single, separated and divorced women, on one hand, and the lowest propportions of married women on the other. The second group of districts which can be noted for relatively higher levels of married women include Kwale, Machakos, Kitui, Nyandarua, Uasin Gishu and Baringo /Laikipia. The rest of the other districts demontrate a very high proportion of married women (over 90%) and very low levels of widowed, separated and divorced women. This last category covers most of the districts in Nyanza and Western Provinces. A possible explanation for these differentials in marital status might be the

marriage taboos and other customary laws that govern marital union in each district.

The education level of the mother is divided or categorised into children having mothers with no education, primary education, secondary education and university and college education. It can, however, be noted that 49.4% of mothers in the survey had no education, 43.8% had primary education, 5.5% had secondary education and only 1.3% had either college or university education. Provincially, Coast, Rift Valley and to some extent Western Provinces had the highest proportion of mothers with no education followed by Eastern and Nyanza Provinces and Central Province having the lowest proportion of mothers with no education. In terms of primary education, Central Province is noted for having the highest (58.9%) proportion of mothers with primary education with Coast Province having the lowest percent of mothers (23.4%). The rest of the other Provinces enjoy more or less the same proportion of mothers having primary education (averaging 40%). Like primary education, Central, Western and Eastern Provinces indicate higher proportions of mothers with secondary education, with Coast having the lowest proportion, Nyanza being average and Rift Valley Province having a relatively lower percent (3.9%). In terms of university and college education, almost all the provinces show extrememly low proportions. From these provinces, districts like Machakos, Embu, Nyeri, Muranga, Nyandarua, Kisumu and Bungoma are noted for relatively low proportions of mothers with no education. All these districts including Kiambu District can also be noted for having the highest proportion of mothers with primary education.

Most of these districts along with Nandi, Siaya and Kakamega districts also have the highest percent of mothers with secondary education.

On the whole the data shows that many districts had no proportion of women with university or college education and these include Kitui, Embu, Uasin Gishu, Elgeyo Marakwet/West Pokot, South Nyanza, Kisii and Kisumu. The rest of the districts show extremely low proportions of mothers with university and college education. One possilbe explanation for this observation is that most of the mothers with college or university education found in this districts are mostly urban mothers and would have been in their places of work during the sample survey.

The last factor to be considered in terms of the demographic characteristics of the mother is age of the mother. This is analysed from the point of view of mean age of mother, and the frequencies of the proportions of mothers in age 14-19, 20-24, 25-29, 30-34, 35-39, 40-44 and 45 and above. This will help in determining the influence of the age on nutritional status of the child and consequently the risk of Infant-Child Mortality.

The national mean age of mother from the survey stands at 30.2 years with the largest proportion of mothers coming from ages 25-29(27.5%) followed closely by ages 30-34 (21.6%) and 20-24 (21.6%) and 45 years and over. Provincially, Eastern, Nyanza and Central Provinces exhibit a higher mean age of mother than the others. Districtwise, most of the districts from Central Province (Muranga, Kiambu and Nyandarua) and a few from Nyanza

childhood mortality.

The following crosstabulations carried out on the above variables intend to show the relationships of the variables to one another and on the outcome variable (sometimes referred to as a dependent variable) which in this case is level of nutritional status as measured by stunting.

TABLE B3

PROPORTION STUNTED BY MOTHER'S AGE AND EDUCATION

MOTHER'S AGE	MOTHER'S EDUCATION					
	NONE	STD 1-4	STD 5-8	FORM 1-6	COLLEGE/ UNIVERSITY	TOTAL
15 - 19	33	21	12	-	-	17
20 - 24	30	19	24	14	-	24
25 - 29	31	27	20	23	-	26
30 - 34	28	23	16	1	-	23
35 - 39	26	24	17	-	-	25
40 - 44	20	23	5	-	-	20
45 - 49	32	-	-	-	-	27
50 - 54	16	-	-	-	-	16
TOTAL	28	23	19	16	33	24

From Table B3, it is given that education of the mother show a positive relationship to rates of stunting, from no education (28% stunting) through form 1-6 (16%). The apparent positive effect of mother's education is marginally greater between those children with mothers who had no education and those with standard 1-4 education (5% points - 28-23%), then between standard 5-8 and form 1-6 (3% points - 19-16%). Children with mothers having some post secondary education however, had an unexpectedly high prevalence of stunting. Therefore, the positive effect of mother's education on the child's nutritional status does not include the category of college or university education; at this highest level, other, possibly social factors apparently overcome the positive effects of education.

Again, it can be noted that an overall negative trend (i.e. increasing prevalence of stunting) in nutritional status by age of mother between ages 15-19 and 45-49 years, is shown in Table B3. The changes, however, among the intervening age categories are not always consistent. In general, percent stunting by education with the mother's age categories shows the same positive trend, although not as consistently as in the overall relationship with education. Up until the 40-44 years age group, however, children with mothers having no education have consistently higher rates of stunting than children of more educated mothers.

Table B.4 shows crosstabulations done on education of mother by water source. Here, the relationship of the two variables is assessed with regard to their apparent influence on nutritional stunting. It is shown that among children with the least educated mothers (none and standard 1-4) an effect of water source was still observed and among children living in households without individual piped water an effect on mother's education was still apparent. This apparent effect could have arisen from the possible effect of education on poor household amenities, for instance, availability of clean water could overcome poor hygienic practices of non-educated mothers. Conversely it could be possible that the unavailability of clean water could dilute the gains derived from education of the mothers.

Figure 3 shows the prevalence of stunting by number of children ever born to the mother within the mother's age categories. It is found that there are no consistent trends over all the age groups. And that within 20-24 and 30-34 year groups the percent stunting is fairly constant over the number of children born to the mother. The 25-29 and 40-44 age categories show an overall increase in stunting with the numbers of children born. The percent stunted within the 30-35 age category of mothers, shows a striking relationship with the number of children ever born. This lack of clarity in the relationship between the

nutritional status of the young child and the parity of the mother is not surprising. It is, at best, a very complex relationship involving physiological factors of the mother, the socio-economic status of the family (which with the age of the mother), and the number of other children presently living in the household (in terms of economic activity on one hand, and their consumption of food, on the other).

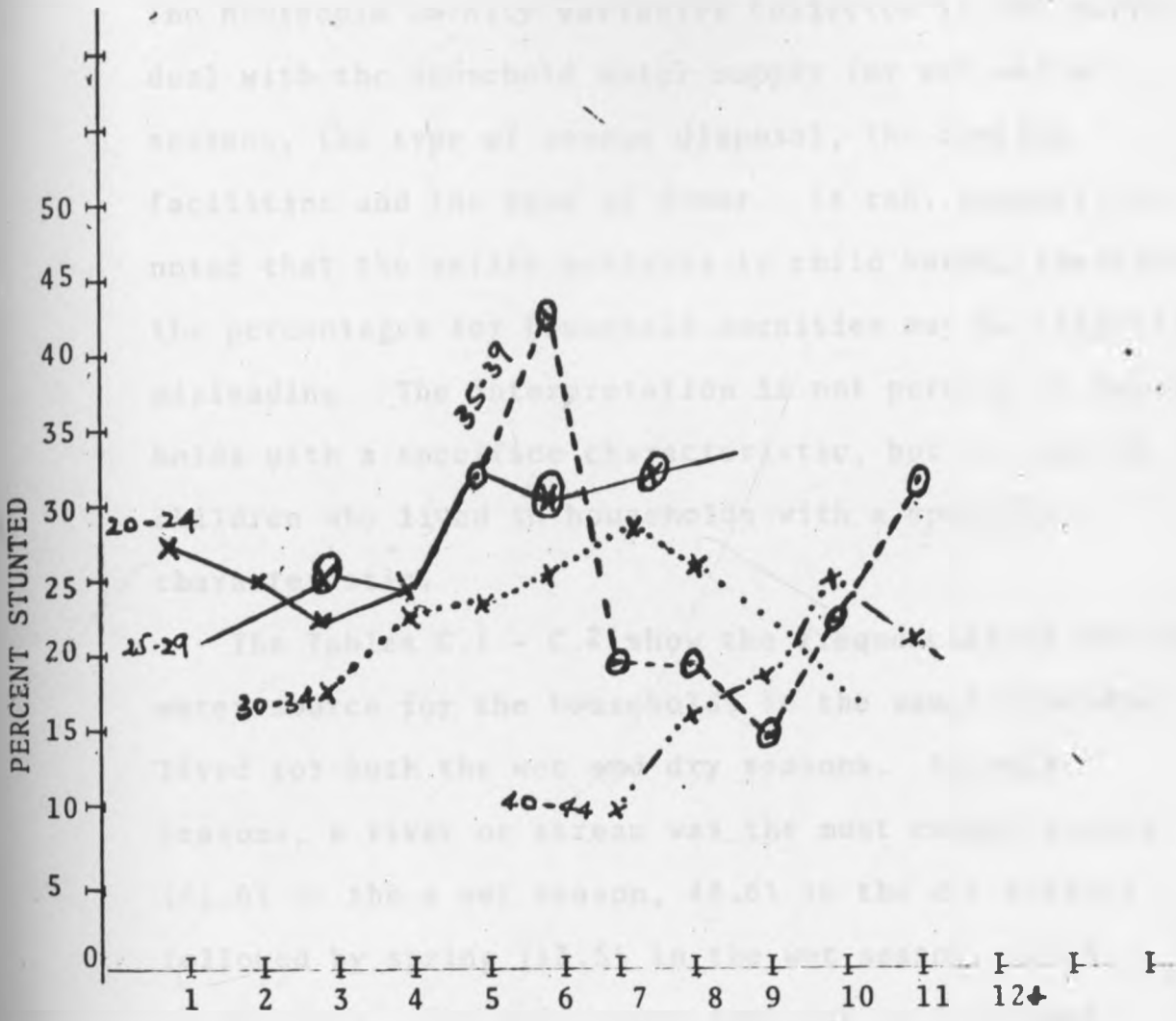
TABLE B.4

PROPORTION STUNTED BY MOTHER'S EDUCATION AND WET SEASON WATER SOURCE

MOTHER'S EDUCATION	WATER SOURCE					TOTA
	INDIVIDUAL PIPED WATER	COMMUNAL PIPED WATER	RAIN, TANK WATER	WELL/ BOREHOLE WATER	STREAM SPRING RIVER, LAKE DAM, WATER	
NONE	16	27	22	28	29	28
STD 1-4	9	18	27	24	23	23
STD 5-8	16	18	16	19	21	19
FORM 1-6	14	15	10	28	14	16
COLLEGE	-	-	-	-	33	32
UNIVERSITY	-	-	-	-	-	-
TOTAL	16	22	21	-	25	24

FIGURE 1.

PROPORTION STUNTED BY CHILDREN EVER BORN WITHIN MOTHER'S AGE CATEGORIES



CHILDREN EVER BORN

KEY

20-24 Age Category

25-29 Age Category

30-34 Age Category

35-39 Age Category

40-44 Age Category

4.3.2 HOUSEHOLD AMENITIES

The frequencies of household amenities by Province and District are shown in TablesC.1, C.2, C.3 and C.4. The household amenity variables collected in the survey deal with the household water supply for wet and dry seasons, the type of sewage disposal, the cooking facilities and the type of floor. It can, however, be noted that the entire analysis is child based, therefore, the percentages for household amenities may be slightly misleading. The interpretation is not percent of households with a specifice characteristic, but per cent of children who lived in households with a specific characteristic.

The Tables C.1 - C.2 show the frequencies of the major water source for the households in the sample children lived for both the wet and dry seasons. In both seasons, a river or stream was the most common source of (41.6% in the a wet season, 48.6% in the dry season), followed by spring (13.5% in the wet season, 13.7% in the dry). The rain water tank was an important source of water in the wet season (12.4%) and understandably not so important in the dry season. Wells, communal piped water, lakes or dams and individual piped water then followed in decreasing frequencies for both wet and dry seasons though differences can be noted when individual districts are considered. This can be seen in the following discussion.

TABLE C.I

FREQUENCIES OF HOUSEHOLD AMENITIES (WATER SOURCE) BY PROVINCE AND DISTRICT

	WATER SOURCE					
	% WITHOUT INDIVIDUAL PIPED WATER	% WITHOUT PIPED WATER WET SEASON	% WITHOUT COMMUNAL PIPED WATER WET SEASON	% COMMUNAL WATER WET SEASON	% SPRING WATER WET SEASON	% RIVER, STREAM WATER WET SEASON
NATIONAL	96.1	88.2	87.0	8.7	13.5	41.6
COAST	99.5	89.3	79.9	19.1	8.3	37.2
KILIFI/TANA RIV./LAMU	100.0	74.7	73.6	26.4	5.1	25.4
KWALE	100.0	86.0	86.4	13.6	16.9	26.7
TAITA TAVETA	97.0	80.5	79.7	17.3	3.0	59.4
EASTERN	97.2	88.2	87.4	9.9	14.0	49.8
MACHAKOS	99.6	95.2	94.7	4.2	14.0	40.9
KITUI	100.0	100.0	100.0	0	5.5	74.9
MERU	92.4	68.4	66.5	24.1	6.4	37.9
EMBU	94.6	89.1	88.2	11.2	17.9	45.4
CENTRAL	88.7	76.3	75.2	12.8	5.7	35.0

TABLE C.I CONTINUED

NYERI	92.7	78.6
MURANGA	84.3	76.2
KIRINYAGA	89.9	77.7
KIAMBU	91.6	75.0
NYANDARUA	88.3	82.4
RIFT VALLEY	96.3	88.7
NAKURU	97.6	85.8
NANDI	89.5	79.6
NAROK/KAJIADO	100.0	93.6
KERICHO	95.6	85.6
UASIN GISHU	98.7	95.2
TRANS NZOIA	100.0	86.8
BARINGO/LAIKIPIA	93.7	93.0
EL MARAKWET/W. POKOT	100.0	98.1
NYANZA	98.9	97.5
SOUTH NYANZA	99.5	99.5
KISII	99.0	99.0
KISUMU	97.7	87.5
SIAYA	98.1	98.1
WESTERN	98.1	95.3
KAKAMEGA	97.9	96.5
BUNGOMA	97.8	89.5
BUSIA	100.0	99.3

78.5	14.1	4.9	30.1
75.3	9.1	5.0	31.5
75.8	14.0	9.3	48.8
74.7	17.5	3.9	26.6
74.7	9.5	5.4	37.8
89.5	6.6	11.3	51.2
83.6	13.5	8.8	36.5
84.8	7.4	28.0	49.0
92.8	7.3	7.8	58.0
91.8	3.3	14.1	42.4
93.3	4.1	16.5	22.7
86.5	13.5	6.5	64.2
87.6	1.8	5.9	58.2
95.3	2.1	2.6	78.9
96.4	2.2	24.9	34.6
99.5	-	7.8	34.3
98.9	-	63.0	16.8
89.2	8.8	2.0	53.4
98.1	-	26.9	33.7
92.8	4.7	26.5	26.1
96.2	1.7	32.4	32.8
82.9	11.8	16.6	18.7
99.3	0.7	30.6	26.9

TABLE C.2

FREQUENCIES OF HOUSEHOLD AMENITIES (WATER SOURCE) BY PROVINCE AND DISTRICT (CONTINUED)

	(WATER SOURCE)					
	% WELL SPRING STREAM RIVER WATER WET SEASON	% WITHOUT PIPED WATER DRY SEASON	% COMMUNAL WATER DRY SEASON	% SPRING WATER DRY DRY SEASON	% RIVER STREAM DRY SEASON	% WELL, SPRING RIVER WATER DRY SEASON
NATIONAL	86.7	86.1	10.0	13.7	48.6	86.1
COAST	79.9	70.5	28.4	5.5	33.5	70.5
KILIFI/TANA RIV./LAMU	73.7	46.9	53.1	0	16.8	46.9
KWALE	86.4	85.6	14.4	14.0	21.2	85.6
TAITA TAVETA	79.6	79.2	17.8	2.5	62.4	79.1
EASTERN	87.6	85.0	11.3	8.3	52.3	85.2
MACHAKOS	95.1	90.5	8.3	16.3	45.5	91.1
KITUI	100.0	98.2	1.8	0	79.9	98.2
MERU	66.5	63.1	29.1	3.9	36.5	63.1
CENTRAL	88.8	88.3	6.1	12.8	55.1	88.3
NYERI	75.8	76.7	12.0	7.7	53.7	76.6
MURANGA	78.6	77.1	13.9	6.6	58.4	77.0

TABLE C.2 CONTINUED

KIRINYAGA	75.4	72.1
KIAMBU	75.8	77.0
NYANDARUA	74.7	83.2
RIFT VALLEY	89.4	90.0
NAKURU	83.4	84.1
NANDI	84.8	85.0
NAROK/KAJIADO	92.7	92.2
KERICHO	91.8	88.0
UASIN GISHU	93.3	94.4
TRANS NZOIA	86.6	86.5
BARINGO/LAIKIPIA	87.7	91.7
EL MARAKWET/W. POKOT	95.2	97.9
NYANZA	94.7	96.0
SOUTH NYANZA	99.5	98.5
KISII	98.9	98.9
KISUMU	82.4	88.5
SIAYA	98.1	98.1
WESTERN	93.8	94.7
KAKAMEGA	99.3	95.8
BUNGOMA	82.9	88.9
BUSIA	99.3	99.3

9.6	6.4	58.0	72.0
12.4	12.4	55.3	76.9
5.9	3.3	50.2	83.2
6.9	13.0	57.3	90.0
13.5	10.6	47.1	84.2
7.1	28.5	51.8	85.1
7.8	7.3	60.6	92.3
4.9	17.4	66.3	88.0
4.1	20.1	31.4	94.3
13.5	6.5	67.9	86.5
1.8	10.0	52.4	91.8
2.1	3.2	80.7	97.8
2.6	26.7	35.5	96.0
1.0	10.8	41.7	98.5
0	70.1	21.2	98.9
9.5	2.0	59.9	88.5
-	24.0	49.0	98.1
3.9	25.5	32.1	94.7
2.1	32.6	37.7	95.8
9.0	11.7	26.6	88.8
0.7	32.1	32.1	99.3

TABLE C.3

FREQUENCIES OF HOUSEHOLD AMENITIES (DISTANCE TO WATER SOURCE AND SEWAGE FACILITIES) BY PROVINCE AND DISTRICT (CONTINUED)

	DISTANCE TO WATER SOURCE (KM)								SEWAGE			
	WET SEASON				DRY SEASON							
	% 0	% 1KM	% 2KM	% MORE THAN 2KM	% 0	% 1KM	% 2KM	% 72KM	% NONE	% MAIN SEWEAGE	% PIT LATRINE	% OTHER
NATIONAL	53.9	34.3	10.9	11.9	39.4	34.8	25.1	25.9	33.9	0.7	63.7	1.7
COAST	41.3	46.7	12.0	12.6	24.2	33.3	42.1	42.5	54.2	1.5	43.3	1.0
KILIFI/TANARIV./LAMU	34.5	55.3	11.8	12.2	19.3	28.4	52.3	52.3	66.2	0.5	30.8	2.6
KWALE	38.0	50.0	11.8	11.9	10.3	38.0	51.2	51.6	81.1	2.0	16.5	0.4
TAITA TAVETA	51.3	34.9	13.2	13.8	42.9	33.5	22.8	23.5	15.3	2.0	82.7	-
EASTERN	50.5	36.6	11.4	12.9	30.8	35.8	34.1	33.4	36.4	0.1	62.3	1.1
MACHAKOS	56.6	36.0	7.2	7.4	19.5	43.8	37.5	36.6	35.7	-	63.9	0.4
KITUI	34.1	49.8	16.1	16.2	16.7	29.9	50.8	53.4	70.4	-	26.9	2.6
MERU	55.3	29.8	14.1	14.9	47.6	34.0	17.5	18.3	20.5	-	78.6	1.0
EMBU	56.0	30.9	13.6	13.0	39.6	35.6	25.0	25.2	19.1	0.5	79.9	0.5
CENTRAL	76.8	39.0	3.2	4.2	60.4	31.9	6.3	7.7	1.8	0.5	97.0	0.7

TABLE C.3.CONTINUED

NYERI	74.1	25.9	0	0
MURANGA	90.1	9.9	0	0
KIRINYAGA	68.9	24.4	6.8	6.7
KIAMBU	86.1	11.3	2.6	2.6
NYANDARUA	64.5	23.3	14.2	11.8
RIFT VALLEY	54.8	33.9	11.0	11.5
NAKURU	44.9	36.7	17.4	18.4
NANDI	82.7	14.3	2.5	3.0
NAROK/KAJIADO	26.8	46.0	27.9	27.2
KERICHO	61.6	28.2	9.7	10.0
UASIN GISHU	62.0	28.1	11.1	9.8
TRANS NZOIA	77.5	22.1	0.5	0.5
BARINGO/LAIKIPIA	39.3	46.0	14.0	14.7
EL MARAKWET/W. POKOT	42.6	49.5	7.4	8.0
NYANZA	38.1	39.6	21.6	22.3
SOUTH NYANZA	44.8	40.9	14.1	14.4
KISII	40.4	30.9	28.9	28.6
KISUMU	40.0	42.8	16.6	17.3
SIAYA	27.2	43.7	29.1	29.0
WESTERN	52.2	38.3	6.1	9.5
KAKAMEGA	66.0	32.4	1.6	1.6
BUNGOMA	35.3	44.0	21.3	20.7
BUSIA	55.2	38.6	6.3	6.3

55.1	42.9	2.0	2.0	0	-	99.4	0.6
73.7	23.5	2.6	2.9	2.8	1.4	95.4	0.5
59.8	32.5	7.8	7.2	4.1	-	95.9	-
69.1	25.7	5.3	5.1	0	1.3	98.7	-
44.1	34.7	23.0	21.1	2.1	-	95.7	2.2
41.5	34.6	23.3	23.9	49.5	1.1	46.2	3.2
23.0	41.6	33.9	35.3	15.9	-	84.1	-
77.2	19.8	2.5	3.0	55.3	3.9	39.6	1.2
12.1	38.9	41.7	49.0	79.6	1.5	15.3	3.6
31.0	37.1	26.3	31.1	73.6	1.6	23.7	1.1
51.5	33.5	15.4	14.9	49.7	-	47.2	3.0
74.1	24.1	20.0	1.9	25.1	-	71.6	3.3
27.7	32.3	39.2	40.0	41.8	1.8	47.1	9.4
34.2	49.5	15.5	16.3	54.9	-	41.0	4.1
25.6	36.9	35.9	37.3	33.0	0.4	66.3	0.4
23.8	38.6	37.5	37.6	68.6	-	30.9	0.5
30.4	38.6	31.4	30.9	17.3	-	81.6	1.1
25.7	47.2	26.8	27.8	8.8	1.4	89.9	-
22.3	23.3	53.5	54.3	37.1	-	62.9	-
44.4	37.1	10.5	18.5	23.1	0.7	73.3	2.8
64.6	34.0	1.6	1.6	16.5	-	77.3	6.3
46.8	40.0	39.2	33.2	24.2	-	74.2	1.5
42.1	37.2	20.5	20.7	28.2	2.1	68.5	0.-

TABLE C.4

FREQUENCIES OF HOUSEHOLD AMENITIES (COOKING FUEL AND FLOOR) BY PROVINCE AND DISTRICT (CONTINUED

	FLOOR			COOKING FUEL				
	% MUD	% WOOD	% BRICK AND CEMENT	% CHARCOAL	% WOOD	% GAS	% ELECTRICITY	% OTHER
NATIONAL	89.0	2.8	8.3	2.8	96.0	0.3	0.1	0.5
COAST	89.3	1.8	8.9	3.3	95.8	0.3	0.3	0.1
KILIFI/TANA RIV./LAMU	93.4	3.6	3.1	1.5	94.4	1.0	1.0	-
KWALE	88.5	0.4	11.1	5.0	94.6	-	-	0.4
TAITA TAVETA	85,9	1.5	12.6	3.5	96.5	-	-	-
EASTERN	86.2	1.8	12.0	1.8	97.4	0.4	-	0.4
MACHAKOS	78.4	1.5	20.1	3.7	94.8	0.7	-	0.7
KITUI	89.7	1.3	9.0	0.4	98.7	-	-	0.9
MERU	85.2	2.9	11.9	1.0	98.1	1.0	-	-
EMBU	91.5	1.5	7.0	2.0	98.0	-	-	-
CENTRAL	86.2	5.3	9.1	4.4	93.1	0.4	-	2.0

TABLE C.4 CONTINUED

NYERI	93.4	1.2	5.4
MURANGA	90.9	3.7	5.5
KIRINYAGA	79.3	12.4	8.3
KIAMBU	79.9	4.5	15.6
NYANDARUA	84.6	4.6	10.8
RIFT VALLEY	90.2	3.0	6.8
NAKURU	94.1	-	5.9
NANDI	83.7	2.3	14.0
NAROK/KAJIADO	91.4	3.5	5.0
KERICHO	90.7	-	9.3
UASIN GISHU	91.7	4.7	3.6
TRANS NZOIA	95.3	1.4	3.3
BARINGO/LAIKIPIA	89.4	8.8	1.8
EL MARAKWET/W. POKOT	85.1	3.1	11.8
NYANZA	90.3	1.2	8.5
SOUTH NYANZA	90.7	1.5	7.8
KISII	94.0	3.3	2.7
KISUMU	89.9	-	10.1
SIAYA	86.7	-	13.3
WESTERN	92.8	2.3	4.9
KAKAMEGA	90.6	3.5	5.9
BUNGOMA	94.8	0.5	4.6
BUSIA	93.0	2.8	4.2

0.6	98.8	-	-	0.6
2.3	96.3	-	-	1.4
2.8	97.2	-	-	-
10.4	79.2	1.9	-	8.2
5.8	94.2	-	-	-
3.6	96.0	0.2	-	0.2
5.9	94.1	-	-	-
5.1	94.2	-	-	0.8
6.6	92.4	1.0	-	-
-	100.0	-	-	-
4.1	94.9	-	-	1.0
1.9	97.7	0.5	-	-
0.6	99.4	-	-	-
4.6	95.4	-	-	-
1.2	98.5	0.4	-	-
1.0	99.0	-	-	-
0.5	99.5	-	-	-
3.4	95.3	1.4	-	-
-	100.0	-	-	-
0.7	98.7	0.4	0.3	-
1.6	96.5	1.2	0.8	-
0.5	99.5	-	-	-
-	100.0	1	1	1

NOTE:

Tables C.I,C.2, C.3 and C.4 should be treate as one. They were put separately becau of lack of horizontal space The same appliie to all the other tables like A.I, A.2, B.1 B.2, D.1, D.2 and E.1.

From the Tables (C.1-4), it is shown that 87.0% of the households in the survey had no piped water in the wet season, which is shown to have reduced to 86.1% in the dry season, and that in the overall 96.1% of the households in which the sample children lived, were without individual piped water. Provincially, Coast province and Central province present the lowest percent of the households with out piped water in both the wet and dry season with Nyanza and Western Provinces showing the highest percent of households without piped water in both wet and dry seasons. Eastern and Rift Valley though relatively showing a higher percent of households in both seasons, fall in between. The districts can be categorised into three starting with those districts with the highest proportions without piped water and these include Kitui, South Nyanza, Busia, Siaya, Kisii, Machakos, Narok/Kajiado, Kericho, Uasin Gishu, Elgeyo Marakwet/West Pokot and Kakamega; with the second category of districts including Kwale, Embu, Nakuru, Nandi, Trans Nzoia, Baringo/Laikipia, Kisumu and Bungoma; and the last category which can be said to have the lowest percentages of households without piped water during both the wet and dry season include Kilifi/ Tana River/ Lamu, Taita Taveta, Meru(lowest), Nyeri, Muranga, Kirinyaga, Kiambu, and Nyandarua. The above percentages given for the first category districts reflect only the situation in the wet season, but it can be noted that there are very slight differences

between the two seasons. From the frequencies given it can also be noted that most districts rely on river and stream water followed by spring water, in both seasons. The districts which rely mostly on river and stream water include Elgeyo Marakwet/West Pokot (highest in dry season - 80.7%); Kitui, Taita Taveta, Narok/Kajiado, Kericho, Trans Nzoia, and Kisumu. The second category districts in terms of reliance on river and stream water in both seasons (wet and dry) include Embu, Nyeri, Muranga, Kirinyaga, Nyandarua, Nandi and Baringo/Laikipia. The last category of districts include Kilifi/Tana River/Lamu, Kwale, Machakos, Meru, Kiambu, Nakuru, Uasin Gishu, South Nyanza, Kisii, Siaya, Kakamega, Bungoma and Busia. While most of the districts rely heavily on river and stream water in both seasons, Kisii district relys heavily on spring water (63% in wet season, 70.1% dry).

The average distance that members of the child's household had to travel to fetch water is 0.7 km. in the wet season and 1.2 km. in the dry season. Viewing the extremes, 46.2% of the children lived in households whose members had to travel more than 1 km. to fetch water in the wet season and 11.9% more than 2 km. The comparable dry season percentages are 59.9% more than 1 km. and 25.9% more than 2km. From the data it can also be noted that the percent who travelled more than 2km. to fetch water decreases in the wet season as compared

to the dry season as might be expected. Kilifi/Tana River/ Lamu, Kwale, Kitui and Siaya are the districts in which over 50% of the children lived households which travelled over 2km in the dry season to fetch water, and districts like Meru, Nyeri, Muranga, Kirinyaga, Kiambu, Nandi, Uasin Gishu, Trans Nzoia, Elgeyo Marakwet/West Pokot and Kakamega fall into the category in which less than 20% of the children lived in households which travelled over 2km in the dry season to fetch water with the rest of the districts falling in between 20% and 50%. The wet season indicates more or less the same trend as the dry season though at this time the percentages of children in the household in each district was slightly less, with districts like Nyeri, and Muranga having no children living in households whose members travel more than 2km to fetch water. Here, both water source and distance to water source were chosen as they can act as a proxy for cleaniliness, for it is given that the longer the distance to water source, the less the water that will be available.

Table C.3 shows the frequencies of the type of sewage disposal. The children in the survey can be said to fall into two main categories in terms of sewage disposal of their household. More than half of the children lived in households which had a pit latrine and 33.9% lived in households with no sewage disposal facilities.

Districtwise, Nyeri, Muranga, Kirinyaga, Kiambu, Nyandarua, Nakuru, Kisii, Kisumu and Taita Taveta had more than 80% of the children living in households which had a pit latrine. And more than half of the children lived in households with a pit latrine in Machakos, Meru, Embu, Siaya, Kakamega, Bungoma and Busia. Whereas districts like Kilifi/Tana River/Lamu, Kwale, Kitui, Nandi, Narok/Kajiado, Kericho, Uasin Gishu, Baringo/Laikipia, Elgeyo Marakwet/West Pokot and South Nyanza indicate relatively low percentages (about 35%) of children living in households with a pit latrine; Kwale, Kilifi/Tana River/Lamu, Kitui, Nandi, Narok/Kajiado, South Nyanza had more than 50% of the children living in households with no sewage facility. With the rest of the other districts showing extremely low percentages of children living in households with no sewage disposal facility (Nyeri and Kiambu show that all households had a sewage disposal facility). The other sewage disposal facilities like the main sewer, septic tank, bucket latrine and cess pool were least utilized in many parts of the districts.

There is, however, little variation in the percent who used wood as the cooking fuel, in most areas nearly everyone used wood. Kiambu district is the only exception to this, more than 10% of households in Kiambu used charcoal as their cooking fuel.

Most children in most districts live in households with mud floors. However, Kwale, Taita Taveta, Machakos, Kitui, Meru, Kiambu, Nandi, Kericho, Kisumu and Siaya districts over 10% of the children lived in dwellings with cement floors. From the data, the survey indicates that most of the children lived in households which used wood as the cooking fuel, and the rest used charcoal and parafin, gas or electricity. And that the majority of children lived in dwellings with mud floors (89.0%); 8.3% lived in dwellings with brick and cement floors and 2.8% with wood floors.

4.3.3 FEEDING PRACTICES

The feeding practices variables selected in this section include proportion of children who ever used formula, average length of breastfeeding, mean age of first supplementation, children supplemented at 4 months or more, type of first supplement with those children who got other milk or porridge as first type of supplement; those children who got main porridge ingredients in regard to that of children who receive maize only, millet only, millet plus maize and cassava children who had milk in terms of cow, goat or other livestock and powdered milk.

From the Tables D.1 and D.2, it can be noted that the highest usage of Infant formula occur in Meru (34.1%), Kitui (31.0%), Embu (29.6%), Taita Taveta (29.4%), Muranga (27.6%), Machakos (25.8%), South Nyanza (24.1%), Kirinyaga (23.6%) and Trans Nzoia districts. The national usage of Infant formula is 20.8%. Provincially, the concentration of high usage is centred in Eastern Province followed by Central and Nyanza provinces. The least usage is centred in the Western Province. The lowest usage of Infant formula occurs in Kericho (9.0%), and Nyandarua (9.0%) districts.

The average length of breastfeeding ranges from 14.0 months in Nyandarua district to 23.1 months in Meru district. The districts which show low levels of the average length of breastfeeding (see Table D.1 for each case) include Taita Taveta, Nyeri, Muranga, Nakuru, Narok/Kajiado, Elgeyo Marakwet/West Pokot, Baringo/Laikipia, South Nyanza and Busia, with the highest including Bungoma, Kitui and Machakos. The national average length of breastfeeding is 18.2 months. It can also be observed that the average length of breastfeeding tends to be longer in the coastal districts; in all of the Eastern Province, in parts of Rift Valley Province and in Nyanza and Western Provinces, except for South Nyanza and Kakamega districts.

The mean age of first supplementation ranges from 1.9 months in Kiambu district to 5.8 months in Kwale district. The districts which have the highest mean age of first supplementation include among others Kitui, South Nyanza, Kisumu, Siaya, Bungoma and Busia, whereas those with the lowest mean age at supplementation include Elgeyo Marakwet/West Pokot, Kericho, Embu, Kiambu and Muranga districts. The percent age of first supplementation at four months or more follow almost the same trend as mean age of first supplementation. The percent supplementation of four or more months was undertaken for analysis because it is hoped in Kenya that children are given foods supplementary to breastmilk at approximately four months of age. Tables D.1 and D.2 on feeding practices reveal that the percent of children who had not been supplemented by age of six months an examinatio indicate a probable deficiency in the diet. And that over 20% of the children had not been supplemented by six months of age in Kwale, Kitui, Nyandarua, South Nyanza, Siaya, Kisumu, Bungoma and Busia districts. On closer examination there is a concentration of late supplementation in Western and Nyanza Provinces as revealed by the mean age of first supplementation.

On examination of the type of first supplementatio the commonest types were found to be milk other than breastmilk and porridge. It can, however, be noted that

TABLE D.I

FREQUENCIES OF FEEDING PATTERNS BY PROVINCE AND DISTRICT

	% EVER USED FORMULA	AVERAGE LENGTH OF BREAST-FEEDING	AGE OF FIRST SUPPLEMENTATION		TYPE OF FIRST SUPPLEMENTATION	
			MEAN AGE	% SUPPLEMENTATION 4 MONTHS OR MORE	% OTHER MILK	% PORRIDGE
NATIONAL	20.8	18.2	3.5	18.6	30.0	57.3
COAST	19.6	18.7	4.3	24.5	10.1	79.9
KILIFI/TANA RIV./LAMU	16.1	19.8	3.7	13.2	14.4	76.5
KWALE	19.7	18.2	5.8	45.1	5.4	76.4
TAITA TAVETA	29.4	15.1	3.9	18.7	6.3	87.5
EASTERN	29.5	21.0	3.5	19.4	36.0	52.8
MACHAKOS	25.8	20.6	3.5	17.6	46.1	42.3
KITUI	31.0	20.3	4.6	36.5	38.2	52.9
MERU	34.1	23.1	3.1	13.5	19.0	68.2
EMBU	29.6	19.0	2.8	10.5	35.6	55.1
CENTRAL	20.0	16.0	2.9	13.5	37.7	32.7

TABLE D.I CONTINUED

NYERI	17.8
MURANGA	27.6
KIRINYAGA	23.6
KIAMBU	15.3
NYANDARUA	7.6
RIFT VALLEY	16.8
NAKURU	18.8
NANDI	12.9
NAROK/KAJIADO	19.1
KERICHO	9.0
UASIN GISHU	18.8
TRANS NZOIA	23.3
BARINGO/LAIKIPIA	19.6
EL. MARAKWET/W. POKOT	22.1
NYANZA	20.2
SOUTH NYANZA	24.1
KISII	16.6
KISUMU	19.8
SIAYA	18.5
WESTERN	16.3
KAKAMEGA	16.5
BUNGOMA	16.3
BUSIA	14.8

14.5	3.1	19.3	30.3	46.2
15.3	2.8	14.2	49.7	19.7
18.8	3.5	18.0	34.8	47.1
16.6	1.9	0.6	34.8	15.7
14.0	3.8	21.9	24.6	65.9
16.6	2.8	11.6	42.1	47.3
14.6	3.3	19.5	53.4	34.3
17.4	2.7	8.8	27.9	60.8
15.3	3.7	17.1	41.9	39.2
16.3	2.3	6.3	23.8	72.4
17.7	3.0	12.4	69.0	25.9
18.1	3.3	17.2	33.1	60.5
15.3	3.1	14.1	35.9	39.3
15.0	2.0	4.2	69.2	22.1
17.6	4.9	27.4	21.5	76.4
15.7	5.3	38.7	12.4	84.5
17.2	3.3	13.0	31.4	68.1
17.1	4.4	28.5	27.1	71.5
18.0	4.6	33.1	13.9	81.5
19.1	3.8	22.4	12.1	76.1
16.5	3.5	19.3	10.4	79.1
22.0	4.3	30.9	18.6	70.0
19.2	4.5	25.5	11.2	76.3

TABLE D.2

FREQUENCIES OF FEEDING PATTERNS BY PROVINCE AND DISTRICT CONTINUED

	MAIN PORRIDGE INGREDIENT			MILK		
	% MAIZE ONLY	% MILLET ONLY	% MAIZE + MILLET AND CASSAVA	% COW GOAT, OTHER LIVESTOCK	% POWDERED	% NONE
NATIONAL	29.4	12.2	21.3	68.4	4.3	27.3
COAST	95.6	2.5	0.8	27.7	7.0	65.3
KILIFI/TANA RIV./LAMU	97.5	1.2	1.3	20.6	6.1	73.3
KWALE	94.8	2.6	0.4	29.4	5.9	64.7
TAITA TAVETA	91.9	6.1	0	43.9	11.3	44.8
EASTERN	33.0	26.4	22.7	69.7	7.7	22.6
MACHAKOS	36.0	33.9	27.8	80.8	5.9	13.4
KITUI	37.2	17.4	13.6	54.0	5.7	40.3
MERU	7.3	16.6	22.1	61.4	11.8	26.7
EMBU	21.9	36.7	20.0	75.4	8.3	16.4
CENTRAL	36.1	10.5	45.7	90.0	1.6	8.4
NYERI	10.6	4.5	75.2	84.5	1.8	13.7
MURANGA	34.4	18.0	41.5	88.0	1.4	10.6

TABLE D.2 CONTINUED

KIRINYAGA	15.7	25.1	45.9
KIAMBU	55.2	4.0	33.9
NYANDARUA	62.6	1.2	32.4
RIFT VALLEY	63.3	11.3	18.8
NAKURU	64.2	6.6	29.2
NANDI	90.4	0	6.4
NAROK/KAJIADO	60.5	2.4	11.0
KERICHO	32.9	32.2	29.3
UASIN GISHU	92.1	4.3	0
TRANS NZOIA	97.2	0.6	1.1
BARINGO/LAIKIPIA	33.1	18.0	35.3
EL MARAKWET/W. POKOT	73.7	4.8	19.6
NYANZA	68.0	7.2	23.9
SOUTH NYANZA	47.0	15.9	35.1
KISII	98.3	1.1	0.6
KISUMU	55.3	3.6	41.1
SIAYA	56.3	2.4	40.0
WESTERN	91.2	3.9	4.5
KAKAMEGA	94.2	4.1	1.2
BUNGOMA	95.9	2.4	1.1
BUSIA	65.7	5.0	29.2

91.9	0.9	7.1
95.9	1.9	2.5
91.8	2.1	6.1
86.1	0.9	6.1
73.5	2.5	24.0
77.4	0	22.6
97.6	0	2.4
94.3	1.0	4.7
92.7	9.5	6.7
67.1	1.9	31.0
85.4	0.7	14.0
96.7	0.7	2.6
51.4	9.1	39.4
46.4	14.7	38.9
59.2	3.6	37.1
40.3	13.4	46.3
55.5	4.0	40.5
51.9	1.3	46.7
53.6	1.2	45.3
53.5	1.5	45.0
39.0	1.9	59.2

the availability of these types of supplement are geographically determined. From the Tables D.1 and D.2, it is revealed that in Coast, Nyanza and Western Provinces porridge is the predominant first type of supplement. In Eastern Province, although porridge is still predominant, a substantial proportion of children received milk as the first type of supplement. In the remaining Provinces, i.e. Central and Rift Valley, approximately the same proportions of children received milk and porridge as first supplement. The districts which reveal the highest percent of porridge as first type of supplement include all Coast Province districts, Meru, Nyandarua, Nandi, Kericho, Trans Nzoia, all Nyanza and Western Provinces districts, but these districts reveal low percents of other milk as first supplement. The highest percent of other milk as first type of supplement occurs in Machakos, Kitui, Muranga, Nakuru, Uasin Gishu, Elgeyo Marakwet/West Pokot and Narok/Kajiado districts. These districts reveal low percentages of porridge as first supplement. In some areas, the less traditional first supplements are used, e.g. in Machakos, Meru, Nandi, Narok/Kajiado, Baringo/Laikipia and Busia districts over 10% of the children received infant formula as a first supplement, and in Muranga and Kiambu districts, 22 and 37% respectively, of children received commercial baby food first.

Three main ingredients are observed in porridge and these are maize, millet and cassava. For examination of the Tables D.1 and D.2, the main porridge ingredients are categorised into maize only, millet only, maize plus millet and cassava. In Coast Province, over 90% of the children in all three districts received a maize porridge while showing extremely low per centages of millet porridge (2.5%) or maize plus millet and cassava porridge (0.8%). In Eastern Province, there is a spread among the three categories for all the districts. The sums of these percentages for Meru and Embu districts potatoes or bananas as the major ingredient in their porridge, and in Embu 20% received a banana porridge, 21.9% maize, millet 36.7% and maize plus millet and cassava. In Central Province, there is, again a spread among the three categories, however, in Nyeri, Muranga and Kirinyaga districts there is a predominance of children who received maize plus millet porridge, and in Kiambu and Nyandarua districts there is predominance of maize only porridge. In Rift Valley Province there is predominance of maize only except in Kericho and Baringo/Laikipia districts where there appears to be a spread among the three categores. In Nyanza Province most children either recieved a maize only porridge or a maize plus millet porridge except in Kisii District where 98.3% of the children received a maize only porridge (given the abundance of maize in the District).

In Western Province as a whole most children received a maize only porridge (Bakamega (94.8%) and Bungoma (93.9%), however, in Busia District 65.7% received a maize only porridge and 29.2% of the children received a maize plus millet porridge. The main porridge ingredients in an area probably represent the crops grown in that area (geographic determination along with the traditional child feeding practices) It can, however, be noted that maize porridge is the most popular given that over 50% of the children in the survey received maize only porridge with exceptions noted in Nyeri district which had 75.2% of the children receiving maize plus millet and cassava porridge. The implications of having over 50% children in survey receiving maize only porridge as first supplement can be seen in their negative effective on nutritional status of the children in these areas, as maize is only an energy giving food.

Table D.1 and D.2 reveal frequencies of children who received milk as part of their diet. This variable was selected because milk is an important constituent of the child's diet. In Coast Province as a whole most children had not received any milk besides, breast milk This can be said to reflect the high levels of malnutrition (high pevalence of stunting) in the area. Taita Taveta is the exception in which 55.2% (43.9% from cow, goat or other livestorck.and 11.3% powdered) of the children had received milk. In Eastern, Central and Rift Valley Provinces, most children had received milk as part of their diet.

In Nyanza and Western Provinces, although over 50% had received milk, a substantial proportion had not (39.4% had received none in Nyanza and 46.7% in Western). When children had received milk, the majority received less powdered milk and more fresh milk. In Taita Taveta, Meru, South Nyanza and Kisumu districts, however, over 10% of the children received powdered milk with no child receiving any powdered milk in Nandi and Narok/Kajiado districts, Kwale, Kilifi/Tana River/Lamu, Taita Taveta, Machakos, Kisumu, Siaya, Kakamega, Bungoma and Busia districts had the highest per cents of children who received no milk.

Table D. 3 show the tabulations made on the average length of breastfeeding by age of mother, the table, however, reveals that there is a general increasing trend in length of breastfeeding with increasing age of mother as might be expected. But a temporary decrease in length of breastfeeding occurs in the 25-29 and 30-34 year age groups.

The Educational level of the mother has often been used as proxy for the socio-economic status of the household. It may also be related to the occupation of the mother and the time she has to spend with the children. This is why the average length of breastfeeding by education

TABLE D.3

AVERAGE LENGTH OF BREASTFEEDING BY AGE OF MOTHER (YEARS)

AGE OF MOTHER (YEARS)	AVERAGE LENGTH OF BREASTFEEDING (MONTHS)
15 - 19	18.1
20 - 24	18.3
25 - 29	17.0
30 - 34	17.8
35 - 39	18.5
40 - 44	20.3
45 - 49	19.5

of the mother is crosstabulated (see Tables D.4 and D.5). It is observed that with the slight exception of the Form 1-6 category, there is a decreasing trend of breastfeeding with increasing education of the mother. This is because most educated mothers tend to spend more time at their place of work than with their children.

Table D.5 shows the prevalence of stunting by age category of the child and whether the child was currently still breastfeeding at the time of the survey within mother's education categories. For children with mothers having no education, those children who were still being breastfed have consistently lower prevalences of stunting than those who had completed breastfeeding.

TABLE D.4

AVERAGE LENGTH OF BREASTFEEDING BY EDUCATION OF MOTHER

EDUCATION	AVERAGE LENGTH OF BREASTFEEDING (MONTHS)
NONE	19.2
STD 1-4	17.9
STD 5-8	16.8
FORM 1-6	17.1
UNIVERSITY	12.5

The prevalence of stunting changes with age, those children who were still breastfeeding tended to be younger than those who had completed breastfeeding, therefore it would have appeared that there was a positive effect of breastfeeding in the totals even if there had not been an effect within age groups. The effect is, however, not as consistent in those children with mothers having some (primary) education. Table D.5 provides evidence to indicate that prolonged breastfeeding may be advantagious especially among children of uneducated mothers. This may also explain the differential levels of stunting and mortality in the districts sampled in the survey.

TABLE D.5

PROPORTION STUNTED BY AGE GROUP OF CHILD AND CURRENT BREASTFEEDING STATUS, WITHIN EDUCATION OF THE MOTHER

MOTHER'S EDUCATION:NONE

AGE GROUP (MONTHS)	STILL BREASTFEEDING	NOT BREASTFEEDING	TOTAL
3 - 11	17	19	17
12 - 23	24	29	27
24 - 25	26	36	35

MOTHER'S EDUCATION: STD 1-4

AGE GROUPS (MONTHS)	STIL BREASTFEEDING	NOT BREASTFEEDING	TOTAL
3 - 11	9	6	9
12 - 23	19	22	21
24 - 35	42	28	28

Table D.6 shows the possible effects of the type of first supplement within education categories of the mother for 3 - 35 month old children. The correlation here is investigated in the multivariate analysis in Chapter 5. However, the results of Table D.6 may in fact be a reflection of the household socio-economic status rather than the feeding practices. Within first supplement categories, the trend of decreased prevalence of stunting within increased mother's education was in

general maintained.

TABLE D.6

PROPORTION STUNTED BY TYPE OF FIRST SUPPLEMENT AND MOTHER'S EDUCATION (3 - 35 MONTHS)

MOTHERS EDUCATION	TYPE OF FIRST SUPPLEMENT				
	OTHER MILK	PORRIDGE	COMMERCIAL BABY FOOD	INFANT FORMULA	TOTAL
NONE	22	30	30	30	27
Std 1-4	12	26	12	20	22
Std 5-8	20	19	16	16	19
Form 1-6	12	24	-	22	18
TOTAL	**20**	26	**18**	21	**24**

- fewer than 20 children in the cell.

The 6 - 35 month old age group of children is probably the one which receives a substantial amount of their nutrients from porridge. Within this group, there does not appear to be any association between porridge ingredients and additives, and nutritional status. There does appear to be a positive association of nutritional status with whether the child was currently breastfeeding within porridge groups. However, this association is probably due to the fact that those children who were still currently breastfeeding were younger than those not currently breastfeeding and it

has been shown that the younger children in this sample have in general, lower levels of stunting.

TABLE D.7

PROPORTION STUNTED BY TYPE OF FIRST SUPPLEMENT AND MOTHER'S EDUCATION (36 - 60 MONTHS)

MOTHER'S EDUCATION	TYPE OF FIRST SUPPLEMENT				
	OTHER MILK	PORRIDGE	COMMERCIAL BABY FOOD	INFANT FORMULA	TOTAL
NONE	26	30	27	18	29
Std 1-4	22	24	-	37	24
Std 5-8	16	16	33	25	18
Form 1-6	23	11	-	-	14
TOTAL	23	25	25	26	25

\- fewer than 20 children in the cell

Table D.7 examines the possible effects of weaning practices on older children (36 - 60 months). Here, proportions of children stunted by type of first supplement within mother's educational status for older children are presented. Those children who received either commercial baby food or infant formula as their first supplement tended to have higher prevalences of stunting than those having received other milk or

porridge, within educational groups. The only exception is the children with uneducated mothers who receive infant formula as a first supplement. This group have a relatively low prevalence of stunting (18%) which is not as expected and thus needs further investigation. This is done in the next Chapter where levels of stunting are regressed against levels of education of the mother.

It can further be noted that no associations between porridge ingredients and additives, and stunting are found in this group (36 - 60 months) of children, except that those children receiving porridge with no additional ingredients have a higher prevalence of stunting (34%) than those receiving porridge with milk (23%), sugar (25%), or milk with sugar (26%).

4.3.4. MORBIDITY PATTERNS

The frequencies calculated on morbidity include variables like cases of children who had malaria, those who were sick, sickness type (fever, fever plus diarrhoeal, vomitting, diarrhoeal/vomitting), those ill three days or more; those from whom food was withdrawn, of those ill who received medical (professional) attention, and of those ill 3 days or more who received medical (professional) attention.

These variables were calculated from the sample on the basis of whether the child had been ill in the last two weeks prior to interview, and the duration, type of illness and the actions taken. It can also be noted that the survey was carried out during the period of June - September, 1982, during which the weather conditions prevailing were mainly characterised by short rains and low temperatures in most parts of the country. The weather conditions prevailing at this time can be said to have had a bearing on the prevalence of sickness two-weeks previously during the time of the interview (when the survey was being carried out).

The frequencies of child morbidity by province and district are found in Table E.1. The national average of sick children was found to be 46.5%, those ill three days or more was 15%, those having fever 21.4%, and malaria cases was 19.1%. Provincially, Coast and Western Provinces tend to have much higher proportions of children who had been ill in the last two weeks than Central or Rift Valley Provinces, and Eastern province lies somewhere in between as has been shown in Table E.1. Examination of the proportions of children who had been ill for more than 3 days in the last two weeks, except that the difference among

Coast, Eastern, Central and Rift Valley Provinces become less distinct. The most common symptom of those ill is fever throughout the whole country. Less than half of who had been ill for more than three days in the last two weeks in Taita Taveta, Machakos, Muranga, Trans Nzoia and Elgeyo Marakwet/West Pokot districts, were taken for professional medical help, probably indicating lack of medical services in those areas. The highest percent of children from whom food was withdrawn when ill is found in the following districts: Nyandarua, Baringo/Laikipia, South Nyanza and Kisii with the lowest percent found in Kitui, Kericho, Embu, Machakos, Meru, Elgeyo Marakwet/West Pokot and Muranga. The highest malaria percent cases are found in Nyanza, Western and Coast Provinces, with the lowest percent found in Central Province. The districts with the highest percent include South Nyanza, Kisumu, Siaya, Kakamega, Bungoma, Busia, Kilifi/Tana River/Lamu and Kitui, with the lowest percent in Nyeri (1.4%), Nyandarua, Kiambu and Nakuru districts. The malaria percent cases was selected because malaria in this country is a serious problem and is said to be a major contributing factor to childhood mortality (19.1%).

Table E.2 is part of the tabulations carried out to assess the influence, and relationships between the morbidity variables. Table E.2 presents the percent of

TABLE E.1

FREQUENCIES OF CHILD MORBIDITY BY PROVINCE AND DISTRICT

	% SICK		TYPE OF SICKNESS					RECEIVED MEDICAL ATTENTION	
	% ill	% Ill 3 days	% fever	% fever + diarrhoea and vomitting	% diarrhoea and vomitting	% malaria cases	% food withdrawn of those Ill	% those Ill	% of those Ill 3 days or more
NATIONAL	46.5	15.1	61.7	21.4	12.2	19.1	17.9	52.9	57.4
COAST	54.3	29.9	71.1	15.3	9.9	24.5	15.9	48.6	55.5
KILIFI/TANA RIV./LAMU	64.1	32.2	70.4	16.4	10.0	25.8	14.5	44.1	52.1
KWALE	43.4	24.8	66.9	17.7	10.9	23.8	17.0	55.0	65.7
TAITA TAVETA	46.5	30.4	80.8	6.4	8.2	23.9	19.4	48.5	48.8
EASTERN	43.4	28.0	67.6	13.7	14.2	19.2	6.7	46.8	52.8
MACHAKOS	46.9	27.4	71.6	10.3	11.7	19.6	7.8	41.6	46.9
KITUI	37.9	22.5	73.6	11.7	12.3	25.0	1.1	44.8	59.9
MERU	41.0	31.6	60.7	16.4	19.4	15.7	8.0	52.2	54.9
EMBU	45.0	31.5	55.4	25.4	16.9	16.7	7.5	58.8	61.3
CENTRAL	37.1	22.6	61.8	21.0	9.9	6.7	17.9	58.7	60.3
NYERI	44.9	23.6	68.7	19.3	8.0	1.4	23.1	79.2	85.8
MURANGA	42.1	24.5	61.3	24.0	7.9	11.3	10.9	42.0	42.0

TABLE E.I CONTINUED

KIRINYAGA	35.3	25.7	50.3
KIAMBU	30.6	19.5	60.5
NYANDARUA	25.4	18.0	64.4
RIFT VALLEY	39.1	26.5	64.5
NAKURU	43.6	31.0	58.3
NANDI	48.1	28.8	66.0
NAROK/KAJIADO	32.1	18.9	61.8
KERICHO	25.4	18.4	49.9
UASIN GISHU	24.7	18.6	81.5
TRANS NZOIA	41.8	25.7	64.6
BARINGO/LAIKIPIA	47.7	32.2	68.2
EL MARAKWET/W. POKOT	49.3	41.1	74.6
NYANZA	58.8	37.2	60.4
SOUTH NYANZA	58.4	32.8	56.0
KISII	57.7	42.4	61.5
KISUMU	60.7	43.0	51.5
SIAYA	61.1	29.6	79.1
WESTERN	56.8	37.9	48.2
KAKAMEGA	56.4	41.2	42.9
BUNGOMA	49.6	28.8	55.0
BUSIA	72.6	35.4	65.1

32.3	13.5	14.4	20.8	71.1	70.2
12.3	10.2	4.5	16.2	60.9	62.7
14.6	19.3	1.7	35.4	58.6	55.5
21.1	10.8	15.2	19.1	55.5	56.8
26.3	10.4	9.2	28.5	58.1	62.7
16.0	14.5	13.8	14.3	57.3	58.0
11.9	20.3	15.8	21.7	73.8	69.7
40.0	8.6	14.9	6.9	63.4	71.3
10.5	8.0	19.8	20.0	46.7	54.7
25.6	8.7	17.5	24.5	52.4	49.1
18.5	7.3	12.2	32.2	58.2	57.0
13.5	8.0	18.6	10.7	38.8	36.9
20.8	12.7	30.0	32.0	59.2	62.1
17.6	19.7	31.6	37.6	58.5	60.1
26.7	9.1	20.9	33.2	60.4	62.5
24.4	9.9	34.7	17.7	67.7	72.3
9.8	6.3	32.6	28.1	47.7	50.9
34.5	13.8	29.7	12.9	49.2	57.2
41.2	12.4	31.0	13.0	49.0	56.2
23.0	16.7	30.4	12.3	53.8	62.6
17.0	17.0	27.6	13.2	44.4	56.2

children ill in the past two weeks by the type of wet season water supply and the presence of sewage disposal facilities. This level of analysis was undertaken because arguments have been put forward vis-a-vis water supply and sanitation, illness experience, nutritional status and their relationship with Infant and Child Mortality. From the Table (E.2), it is shown that there is a tendency for those children who lived in households with individual piped water, rain tank, or communal piped water to have lower incidences of illness in the previous two weeks, these are also groups which had lower prevalences of stunting. This, however, may be due to the higher socio-economic status of these chidren and not a direct relationship through morbidity.

TABLE E.2

PROPORTION ILL IN THE PREVIOUS TWO WEEKS BY WET SEASON WATER SOURCE AND PRESENCE OF SEWAGE FACILITIES

WATER SOURCE	SEWAGE FACILITIES		TOTAL
	NO FACILITIES	SOME FACILITIES	
Individual Piped	-	39	40
Communal Piped	48	43	44
Rain Tank	40	41	41
Well/Borehole	49	46	47
stream, spring River, Lake, Lam	46	50	48
TOTAL	46	47	46

- fewer than 20 children in the cell.

CHAPTER 5

SELECTED FACTORS AFFECTING CHILD MORTALITY IN KENYA

5.1 INTRODUCTION

Child mortality is affected by many different and interrelated demographic, social economic and health factors. Factors such as income, education, social class, occupation, urbanization, sanitation and availability of health services are well known correlates of child mortality. As might be expected, these conditions are also highly intercorrelated in such a way that their relationships and the relative potential of each in the reduction of mortality is difficult to disentangle. Aggregate data analysis, on the local, national and international levels have not always produced definitive or uniform results.

Child mortality in part reflects the state of public health and hygiene, environmental sanitation, cultural mores about feeding and clothing; and socio-economic development. At present, there is still some imbalance between the emphasis given by planners to economic development in general, and/or specific programmes such as education, sanitation or health services. From a policy point of view, however, it is necessary to identify those factors which are determinant and amenable to change.

This study considers in more detail those factors which are pertinent to programme activities in the rural areas of Kenya. In particular, emphasis is given to:

1. family formation patterns (demographic characteristics of the mother) and the effect of these patterns on child mortality.

2. Nutritional factors (feeding patterns).

3. Socio-economic and environmental factors (household amenities and morbidity patterns).

This study identifies some of the factors that influence child mortality in Kenya, and application of multivariate analysis was done to predict some possible changes in the level of child mortality. The variables which are subjected to the multivariate analysis include, marital status, educational levels of the mother, age of supplementation, sewage facilities, illness and length of breastfeeding. It should be noted that multivariate analysis was carried out on these variables, as to reinforce the descriptive analysis that was done in chapter 4 of this study. Another aspect to be taken into account is that the high R^2 (cumulated Rs) as shown in Table 4B was due to multi-collinearity resulting from intercorrelation between variables as evidenced in the correlation coefficients (see Table 4A).

TABLE 4A: RELATIONSHIP BETWEEN THE SELECTED INDEPENDENT VARIABLES AND CHILD MORTALITY

VARIABLES	V01	V11	V09	V06	V03	V10	V05	V04	V08
V01 CHILD MORTALITY RATE	1.0000	0.69002	0.60818	-0.31816	0.31936	0.16734	0.41708	0.43902	0.27651
V11 PROPORTION OF CHILDREN WHO WERE ILL	0.69002	1.0000	0.39821	0.04622	0.27707	18832	-0.24307	0.20624	0.00361
V09 MEAN AGE OF SUPPLEMENTATION	0.60818	0.39821	1.0000	-0.08681	-0.24991	0.21923	-0.39604	0.37235	0.31002
V06 PROPORTION OF CHILDREN WITH MOTHERS HAVING SEC. ED. +	-0.31816	0.04622	-0.08681	1.0000	0.39691	0.10649	0.40950	-0.56827	-0.55105
V03 PROPORTION OF SINGLE SEPARATED, DIVORCED AND WIDOWED MOTHERS	0.31936	0.27707	-0.24991	0.39691	1.0000	-0.18638	0.32471	-0.36820	-0.40527
V10 AVERAGE LENGTH OF BREASTFEEDING	0.16734	0.18832	0.21923	0.10649	0.18638	1.0000	-0.19050	0.15075	0.12976
V05 PROPORTION OF CHILDREN WITH MOTHERS HAVING PRIMARY EDUCATION	-0.41708	-0.24307	-0.39604	0.40950	0.32471	-0.19050	1.0000	-0.98324	-0.73464
V04 PROPORTION OF CHILDREN WITH MOTHERS HAVING NO EDUCATION	0.43902	0.20624	0.37235	-0.56827	-0.36820	0.15071	-0.98324	1.0000	0.77357
V08 PROPORTION OF CHILDREN IN HOUSEHOLDS SEWAGE FACILITIES NONE	0.27651	0.00361	0.31002	-0.55105	-0.24991	0.12976	0.12976	0.77357	1.0000

5.2 RESULTS OF THE REGRESSION ANALYSIS

In this chapter, results of regression analysis are presented, on whether mortality differentials in Kenya are due to the differential influences that are exerted on mortality by some social, economic, demographic and health factors found in different districts. These factors are viewed as having had some independent or associated underlying influences on current mortality differentials.

The results of the multivariate analysis between independent variables and child mortality are given in Tables 4A and 4B.

Marital status (single, divorced, separated and widowed) and education of themother (mothers with no education) were hypothesized to be positively related to child mortality. From our finding this assumption was confirmed (r_s=0.32 and 0.44 respectively). The positive relationship between marital status; education of the mother and child mortality imply that marital stability and increased levels of education of the mothers in the community will greatly enhance child survival, for instance by increasing knowledge on the use and accessibility to medical services, family income stability etc.

Table 4A shows that proportion of children who were sick in the community has a high positive correlation with child mortality levels, (r_s=0.69). This finding confirms our hypothesis that sickness in the community was positively related to child mortality. This positive relationship between sickness and child mortality clearly shows that efforts to control prevalence or incidence of infection coupled with improved nutritional status can greatly enhance child survival in this country.

Thus nutrition and child survival programmes in Kenya should direct their efforts to this two aspects.

The positive relation-ship between age of supplementation, length of breastfeeding and child mortality (r_s=0.6 and 0.17 respectively) confirm our hypothesis that a higher age of supplementation and longer period of breastfeeding will greatly enhance child survival. Given that the national mean age of supplementation is 3.5 months and the national average length of breastfeeding is 18.2, it should be noted that supplementation and breastfeeding if higher than 3.5 months and longer than 18.2 months respectively will greatly enhance child survival, although what the child will be supplemented with will greatly determine its survival.

As expected proportion of children living in households with no sewage facilities correlates positively with child mortality (r_s=0.28). From the findings this assumption confirms our hypothesis that absence of sewage facilities relates positively to child mortality. This can be explained by the fact that environmental sanitation especially sewage disposal will determine the spread of germs in the child's environment.

On examining the inter-correlations between these variati we found that there is a very high correlation between proportion of children with mothers having no education and those with primary education; whereas there was a fairly low correlation between the other remaining variables as shown in the Table (4A). It should, however, be noted that high inter-correlations imply that the variables share the explanatory value of the variation. This aspect, it should be noted was responsible for the high Rs square values as can be seen in Table 4B.

From Table 4A, it is shown that the author tried to minimise this problem by allowing only the educational level variables to share their explanatory values of the variation because, in this study education of the mother is taken as a critical variable in determining child mortality.

Results of the multiple linear regression are presented in Table 4B. The selected independent variables were found to explain 71.3% (cumulated Rs) of the total variation in the dependent variable (child mortality). It further indicate that proportion of single, separated, divorced and widowed mothers; average length of breastfeeding; proportion of childre with mothers having primary education; proportion of children with mothers having no education and proportion of households with no sewage facilities in the community, are not strong indicators of child mortality variation in Kenya. They accou for 3.6%, 1.1%, 0.4%, 4.5% and 0.7% respectively of the variation. This is a very low contribution indeed. Proporti of those ill; age of supplementation and proportion of childr with mothers having secondary education take the upper hand in explaining the variation. Table 4B show that these three variables account for 70.3% of the total variation in child mortality in Kenya. From the same Table 4B it is shown that age of supplementation and proportion of mothers with seconda education in the community explain 13.4% and 9.4% respectively of the total variation in child mortality. The importance and inter-pretation of these two variables is given in the discussion below. When the educational levels of the mother were compared, secondary level (plus) of education has a highe contribution of the variation than the other two levels (primary and no education).

As explained above, the author tried to tackle the problem of multicollinearity by use of step-wise regression analysis and this is reflected in the discussion of the individual and inter-correlated variables in the following analysis.

TABLE 4B: SUMMARY OF MULTIPLE REGRESSION RESULTS ON CHILD MORTALITY

VARIABLES DEPENDENT VARIABLE CHILD MORTALITY RATE (V01)	R SQUARE	SIMPLE R	B	BETA
V11 PROPORTION OF CHILDREN WHO WERE ILL	0.47409	0.68854	0.289995	0.59297
V09 MEAN AGE OF SUPPLEMENTATION	0.60894	0.61002	0.27455	0.36401
V06 PROPORTION OF CHILDREN WITH MOTHERS HAVING SECONDARY EDUCATION+	0.70288	-0.31458	-0.844855	-0.42695
V03 PROPORTION OF SINGLE, SEPARATED, DIVORCED AND WIDOWED MOTHERS	0.70647	0.31636	0.7371002	0.07740
V10 AVERAGE LENGTH OF BREASTFEEDING	0.70754	0.17122	0.7755322	0.03933
V05 PROPORTION OF CHILDREN WITH MOTHERS HAVING PRIMARY EDUCATION	0.70796	0.42247	-0.185776	-0.38386
V04 PROPORTION OF CHILDREN WITH MOTHERS HAVING NO EDUCATION	0.71243	0.47209	-0.006870	-0.38690
V08 PROPORTION SEWAGE FACILITIES NONE	0.71311	0.28616	-0.8220657	-0.04653
(CONSTANT)			63.86230	

Many studies as discussed in the literature review (see Chapter 2) indicate that the demographic characteristics of the mother are more strongly associated with the nutritional status of the child and with child survival. These factors, especially education of mothers (secondary level and above) in the community provide a potent and cost-effective means of reducing nutritional status of the child and child mortality. As indicated in our hypothesis these factors have a strong influence on child mortality because higher educational levels of mothers in the community can be said to have an influence on the weaning practices (especially higher age of supplementation and supplementation foods) and can also determine the family income and environment of the child. For instance, hygienic practices are more pronounced on mothers with a minimum level of education than on illiterate mothers. The same can be said of marital stability which can also be said to influence the length of breastfeeding (by shortening it from 3.5 months).

The demographic characteristics of the mother were considered to measure a variety of things. For instance the illiteracy or children with mothers having no education in the community was considered because of marginality (income with other levels of education etc.) and its associated style of living i.e. poor sanitary conditions, poor sewage disposal, poor nutrition; also because of low levels of income, since employment in the modern sector is directly associated with educational merit, and lastly because of poor knowledge of child care and limited access to medical facilities. Thus, education of the mother works through other routes like knowledge of child care to reduce child mortality. Literate mothers in the community are more likely to break with traditional medicine and adopt new methods of child care. Their innovative behaviour might be better tolerated by the more conservative members of the family because of their educational status.

Education might also contribute towards "child centredness" with all that such a development means for reducing childhood mortality. More of the family resources will be devoted to children; they may take fewer risks; they will almost certainly live a healthier life. The evidence that education of mothers is an important factor in childhood mortality decline is convincing enough despite the uncertainities of exactly how literacy improves child care (Caldwell, 1981). This study indicates that as education works through other routes to influence child mortality, it can therefore be said that the different levels of maternal education was the single most powerful determinant of the level of child mortality. Caldwell in his study from two survys in Ibadan City and in a rural setting came out with the same results.

Marital instability on the side of the mother because of its associated emotional; social conditions and economic stability also determineschild survival. Besides the general adequate nutrition and economic stability of the mother and particularly through her pregnancy a most important requisite for health is peace of mind and emotional stability. It is in this respect that the married mother has a great advantage over the single, separated, divorced or widowed mothers. Similar associations between marital status and childhood mortality were done by Graham in 1972.

The aforegoing discussion on the demographic characteristics of the mother in the community confirm our hypothesis that these variables have an effect on child mortality and nutritional status of the child.

Many studies especially those done in West Africa (Ghana) by Stephens (April, 1984), indicate a strong association between household amenities and childhood mortality. Household amenities especially availability of sewage facilities in the households in the community were analysed in this study because the author felt that the direct and indirect influence of these factors on childhood mortality is relatively high.

But the regression results as shown in Table 4B indicate that absence of sewage facilities in the households in the community explains only 0.7% of the total variation in child mortality. This is a low contribution indeed. This can be explained by the fact that poor sewage disposal and sanitary conditions can work through other routes to influence child mortality and the nutritional status of the child. For instance sewage disposal and sanitary conditions can determine the incidence and prevalence of infection of children in the community. It is assumed that poor drainage and the lack of a system to dispose of human excreta are still a major problem in many districts of this country and that occurrence of illness according to living conditions is high among children who live in households with poor sanitary conditions and where families defecated in the open fields or bush (due to lack of sewage facilities).

Compared to the other variables (as shown in Table 4B) feeding patterns variables like age of supplementation and length of breastfeeding are better predictors of child mortality levels in Kenya than the other group of variables. This observation can be attributed to the fact that supplementary foods, age of supplementation and length of breastfeeding can determine the child's immunity and resistance to disease and infection. Here we are talking of a mean age of supplementation of 3.5 months and an average length of breastfeeding of 18.2 months. The age of supplementation is critical to a child's survival. This is reinforced by the fact that when the correlation coefficients (rs) were considered, it was found that (see Table 4A) mean age of supplementation correlates quite highly with child mortality (r_s=0.61). It was also found (see Table 4B) that age supplementation explains 13.5% of the total variation in child mortality. This is a high contribution indeed.

This is because children in many of Kenya's districts die because of the interactive effect of malnutrition and infection, a process that usually starts at the moment of weaning and exposes to the risk of death children aged 0-5 years. Childhood mortality due to the malnutrition, infection syndrome is today ten to twenty times higher in the rural areas of the developing countries of the world than in other settings. Reductions of mortality in this age group is primarily a function of the timely introduction of nutritional appropriate weaning foods. This should be accomplished, however, without reducing the still widespread and beneficial practice of breastfeeding. Should the present trend of abandoning breastfeeding reach the rural areas, child mortality will inevitably rise even higher.

The above discussion on mean age of supplementation and average length of breastfeeding confirms our hypothesis that, these variables will have a significant positive effect on child survival. And given that these variables are correlated with malnutrition and disease prevalence and infection, the introduction of morbidity (illness) in the undergoing discussion was found timely.

As already indicated illness was hypothesised to be positively related to child mortality. From the findings this assumption was confirmed. Proportion of those children who were ill in the community explain 47.4% of the total variation in child mortality. This is a high contribution indeed. It is hoped that illness will reflect the prevalence and incidence of morbidity patterns in Kenya, for from the regression results morbidity is a better predictor of child mortality than any other variable or even all the other variables combined. The high correlation of illness with child mortality, implies that illness works directly and through other routes to influence child mortality and the nutritional status of the child. collectively, the results indicate that if morbidity conditions are controlled especiall the incidence or prevalence of infection, the the expectancy of life can be greatly raised.

This mainly touch on child survival, for it is assumed that infections are more frequent and common in malnourished populations, and poor nutritional status whether severe or moderate, predisposes children more to severe infections.

However, child mortality can be reduced through improvments in nutritional status. Improving nutritional status has at least two significant effects; better defence agains infection which can otherwise be fatal and a lower risk of severe malnutrition. Infection is one of the causes of malnutrition that cannot be ameliorated by nutrition programmes.

Finally, in this study, the next chapter is addressed to conclusions and recommendations deduced from the aforegoing findings.

CHAPTER 6

CONCLUSION AND RECOMMENDATIONS

6.1. CONCLUSION

In the developed countries of the world, over 97% of all children survive through the preschool years. By contrast, in many poor countries 20-25% of the children die before reaching their fifth birthday, resulting in an estimated 15 million deaths annually (UNICEF, 1984). Many of these deaths are preventable with available health technology (UN Population Division, 1983). A rising global awareness of the unrealized potential for improving health conditions led national governments and international agencies to re-evaluate health service strategies. Community-based programmes have been seized upon by the international health community as the key strategy to make health services accessible, affordable, and socially acceptable.

One should add that our knowledge of mortality determinants and hence that of nutritonal status as a determinant of mortality is poor and the reasons for this are obvious. Specifically, the traditional method of birth registration addresses itself into questions like sex, age, area of residence, ethinicity and religion without an indication of socio-economic characteristics and number at risk.

It also seems that various types of data indicate that the determinants of infections in children with malnutrition are more closely related to the quality of the environment than to the nutritional status of infants and children. However, once a child or infant becomes infected, the severity and duration of the episode will depend on nutritional status. Thus improving nutritional status has at least two significant effects: better defence against infection and a lower risk of severe malnutrition.

The results of this study strongly suggest that maximization of gains in child and infant survival from the provision of better water, toilet facilities, better and effective halth facilities; better dietary and feeding havits and better maternal factors can only be obtained when nutritional status is improved. This is because nutrition interventions do not appear to reduce the incidence of infections, although they decrease mortality rates. One explanation of these seemingly contradictory results is that the mortality rates are reduced through improvements in nutritional status. From the results it can also be concluded that the aforegoing selected factors affecting nutritional status are better predictors of child mortality.

This can be explained by the fact that most of these factors are environmental and therefore are bound to have a greater impact on the child. Age of supplementation and illness are shown as the key determinant factors in child mortality.

Education of the mother especially seconday education is fairly predominant in determining the child's survival. These three factors are fairly correlated with child mortality.

Another important point to note is that there appears to be a synergism between household amenities (sanitary facilities) and child survival such that the relative reduction in child mortality attributable to an improvement of sanitation facilities exceeds the same of the relative reduction attributable to improvements in facilities along and improvements in the status of maternal characteristics.

Feeding patterns as compared to household facilities tend to play a greater role in child survival. A fact which is underscored by the importance of breastfeeding and age of supplementation in child survival. There are high correlations between mean age of supplementation and child mortality. This leads us to the conclusion that timely supplementation and proper food is an important factor in child survival. It can further be concluded that feeding patterns are influenced by other factors like environmental sanitation, maternal characteristics and morbidity patterns in terms of their effect on child's nutritional status and survival. All these factors explain 71.3% of the total variation in child mortality.

As can be expected morbidity contributes more to child mortality than any of the selected factors. The most important morbidity factor is illness with an equally high correlation with child mortality. Illness along explains 47% of the total variation in child mortality.

6.2. RECOMMENDATIONS

Child survival depends upon adequate nutrient intake and the ability of a child to resist or recover from infections. It can further be noted that the basic causes of malnutrition or poor nutritional status in developing countries are socio-economic. Poverty is pervasive in much of the third world, and the capacity of families to purchase and/or produce food is limited. Ignorance of the special needs of children and inappropriate cultural beliefs and practices often cause families to give their children diets that are less in quantity and quality than those they could provide. Conditions of environmental sanitation are typically deficient and, combined with limited access to preventive and curative health care, result in high incidences and increased severity of infectious diseases, problems that in turn adversely affect nutrient utilization.

It should, however, be noted that a change in both education and water statuses should be investigated, for this study assumes that an improvement in both statuses will lead to a reduction in child and infant mortality risks. Similar relationships may be investigated separately for changes in toilet facilities and maternal education. Also to be researched in Kenya should be the apparent synergism

between maternal education and sanitation facilities such that the relative reduction in Infant and Child Mortality attributable to a joint improvement of maternal education and sanitation facilities will exceed the sum of the relative reduction attributable to improvements in facilities alone and improvements in education status. This study casts light on some important issues of public health concern. By combining demographic, socio-economic and public health variables in an unusual manner, it shows that policies which seek to provide better health conditions solely through improvements in sanitation facilities may achieve less than their desired intent. Instead intergrated programmes and policies which improve the quality of facilities jointly with education may reap the maximum advantage. In fact, it is clear that education alone, without modern, decent water or toilet facilities, is in most cases more beneficial to child and infant survival than the provision of modern facilities alone. The exact content or duration of such education is not clear. However, this study suggests that even a minimal level of education from the point of view of demographic characteristics of the mother, provides significant benefits. The relative improvements in infant and child survival are clearly greater at higher levels of education.

The relationship between education and nutritional interventions should be studied, as to determine the role of maternal education in this respect. Nutritional interventions have been shown to improve nutritional status but these same interventions have not been shown to reduce the incidence of infections. Also, there is weak support at best for the hypothesis that nutritional interventions decrease the severity of infections. However, these studies have been plagued by methodological difficulties with the measurement of morbidity and not all intervention studies have been properly analysed in terms of effects, on morbidity. On the other hand, nutritional intervention studies indicate that dietary improvements are associated with lower mortality rates during infancy and early childhood. Finally, nutritional interventions do not appear to reduce the incidence of infections, although they decrease mortality rates. One explanation for these seemingly contradictory contention is that mortality rates, are reduced indirectly, through improvements in nutritional status. Improving nutritional status has at least two significant effects: better defences against infection and a lower risk of severe malnutrition. Infection is one of the causes of malnutrition that cannot be ameliorated by

nutrition programmes.

This study left out income as a socio-economic development factor and recommends that future research should be geared towards income, both on th aggregate level (e.g. GNP) and the individual family level and its close correlation with Infant and Child Mortality. The question often raised, however, is which income-increasing policy may be more effective in reducing Infant and Child Mortalit Also to be studied should be the contention that improvement of sanitary conditions in individual families is of course strictly related to improved income.

There is evidence that no single sectoral intervention such as health care service can suffice in itself to improve the life and the survival of rural populations in developing countries. Neverthe less, it can be stated that while health programmes cannot by themselves solve the problem of infant and childhood mortality, the absence or the removal of such programmes certainly favour a high Infant and Child Mortality. Experience thus far in many different settings confirms that health services alone reduce Infant and Child Mortality, a social problem caused by social ills. Health services, however, are a necessary component of any overall strategy aiming at reducing Infant and Child Mortality. Studies should be done in this

respect giving priority to a combination of utilization of health service in the absence of education and its presence.

For matters of policy and planning the following recommendations are made in accordance with nutritio status; and infant and child mortality.

Given that adequate nutrition is a basic human need and a prerequisite for health, every nation needs some kind of nutritional surveillance to keep watch over nutrition in order to make decisions that will lead to improvements in nutrition in populations. Nutritional surveillance should encompass cases like health and development planning usually at national level; programme management and evaluation; and timely warning and intervention to prevent short-term food consumption crises. These cases are not mutually exclusive, but impose different requirements on the design of nutritional surveillance systems. The need for nutritional surveillance stems from the recognition that the majo cause of malnutrition in the world is poverty. Poverty causes malnutrition through inadequate food availability in households (and perhaps inappropriat distribution within the household) and through insan living conditions and inadequate access to health services. These interrelations can be regarded as flows of resources determining nutritional status as endpoint.

Improvement in nutrition is one of the objectives of basic needs planning, of health for all, and of food and nutrition planning. The measurements used in nutritional surveillance must include many of those defined as health status indicators, particularly with respect to the nutritional status of children and mortality data.

A feasible strategy for tackling health and nutrition problems involves: enhancing the positive effects on nutrition of development policies and programmes mainly in the conventional health and nutrition fields; and preventing short-term critical reductions in food consumption. Success depends on numerous considerations, many of which are political, but knowledge of nutritional problems, their causes and how they are changing, can help in many relevant dicisions.

Decisions are required in the context of both national policies and particular programmes. Decisions on national policies concern resource allocation by area and sector, legislative measures and programmes. Nutritional surveillance provides for better-informed decisions within these areas. Development programmes require choices on targetting by area and socio-economic group, and on the possible effects of different activities on nutrition. Health and nutrition programmes need similar decisions: on targeting by area, and relevance of activities to

causes of malnutrition. Timely warning and intervention programmes to tackle acute food shortages need data to trigger appropriate interventions.

Although mass poverty is often the underlying cause of malnutrition, a general attack on poverty is not necessarily the best means of getting at malnutrition, especially among small children. Income increases and agricultural growth have a major positive effect on the problem of malnutrition and could have much more if nutrition were one dimension in the consideration of income and agriculture policies. But income and agricultural growth of themselves are often unsufficient to meet nutritional needs within a satisfactory period of time. Complementary actions, especially to meet distributional and educational needs, are required.

Of the complementary actions available, these that avoid extensive administrative mechanisms - that is, those with broad applications are especially attractive. Working, for example, through price policies, mass media, seed improvement, or distribution through normal marketing channels- perhaps with subsidy- is usually less costly, less cumbersome, and much quicker than the more common small-scale approaches to malnutrition. Specifications here are difficult to designate, given the different needs and circumstances in different districts in

Kenya - clearly, nutrition programmes must be custom made - but some highlights do emerge from the experience to date.

Given limited resources, and the need to establish priorities, lesser emphasis in low-income countries like Kenya may be appropriate on the development of new foods and ingredients for these foods, and greater emphasis on finding ways to reach those people in need with foods already known and available. Both the mass institutional feeding programmes (under some circumstances they may be the only sure mechanism to reach specific groups of nutritional need) and the market place provide potential; but major changes in orientation will be required if the potential is to materialize. Meanwhile, an unquestioning "more of the same" posture for both vehicles would be ill-advised.

Similarly ill-advised in most countries would be investment, for nutrition reasons, in traditional animal protein products. Increases in production of meat, milk, and eggs seldom have direct impact on malnutrition among the very needy.

The response to malnutrition in most countries is modest, fragmented, and lacking in operational orientation. Given this picture a national nutrition programme requires an awareness of the problem, a commitment to do something about, and implementation. No matter where any particular

country now stands on this scale, what most of them need is a different and broader conception of malnutrition and a quantum in the nature of their response. The problem is massive, and it has hardly been budged. Officials must not be seduced by minor achievements that are often peripheral to the central problem. The "every little bit helps" philosophy that characterizes much of the thinking in the nutrition field may even be counterproductive, since it diverts attention from more significant needs. A small success is meaningful only if it is a useful step on the way to a large success that can be achieved in a short time. The nutrition advocate should insist that nutrition activities be consequential.

To achieve a consequential scale requires totally changing the complexion of nutrition as practiced today. For nutrition to attain a place in the mainstream of development, attention must be directed to the form and scope of nutrition planning and programming, organizational needs, personnel requirement, and research orientation. All require radical change.

Comprehensive nutrition planning and analysis are sclely needed, and with an increased scope of nutrition activities envisioned, this need becomes even more critical. Projects now are generally adopted because someone comes with an idea, with its costs, and with the mechanism to carry it out. In

this way, a little piece may get done - a commercial fabricated food, a fish protein concentrate, a chain of mothercraft centers. The project may or may not be useful in isolation; perhaps other simultaneous actions - extension work, credit provision marketing services, food regulations - must take place to make it effective. The activities that exist today in Kenya in the fiels of nutrition are, more often than not, the result of the persistance and persuaciveness of the project advocate (like UNICEF) rather than of a thoughtful look at total needs and alternative ways of meeting them. For clearer objectives to nutrition planning, a more systematic approach to identifying problem causes and solutions is needed. Nutritional objectives and target groups need to be carefully defined. Also, malnutrition's close relationship to socioeconomic forces should be examined along with a comprehensive and systematic approach to planning analysis.

Strong leadership in nutrition programming and a vigorous, goal-oriented organization with a clear mandate are essential. As things now stand, some of the major factors and policies influencing nutritional status are outside the interest and reach of those people and entities, charged with looking after their country's nutrition, and those who formulate such policies do not specifically include nutrition as part of their planning equation. Moreover, most conscious nutrition efforts have serious implementa-

tion problems, greater even than those in other development fields because of the multifaceted nature of nutrition activities. If a strategy is to concentrate solely or primarily on a single project, such as legume production of school feeding, the programme might well fall under the aegis of the ministry of agriculture or education. If, as is more likely, a nutrition programme consists of several elements - agricultural, health, educational, industrial - the question is where to fix the resposibility.

Nutrition is a relatively new profession and there are many unknowns. A large policy-oriented nutrition research programme that engages both nutrition scientists and social scientist, as well as people with programming skills and operational experience must be mounted. The effort should be well funded to support work of the highest quality. Such a need can be met both on the local, developing country level and through an international institute capable of major investment addressed to solving problems common to many locales and countries.

The consequences of malnutrition (and its contribution to child and infant mortality) for national development are increasingly clear. Without improved nutrition and the factors affecting it in the less-favoured parts of the

world, the development of human resource may well be retarded. It should be clear that we are not talking of the quality of life, but of the quality of people. Unless the current levels of malnutriton are dramatically checked, they may be significantly detrimental to the performance, appearance, physical well-being and perhaps even the mental capability of much of the world's population and of course its survival.

To prevent such scars will require new approaches, new organizational entities, a new discipline, and most important, a new scale of concern about the problem and concomitant new scale of action. Although a great deal of investigation clearly is needed to obtain more precise data and reduce the ranges of uncertainity, knowledge of nutrition - the problems as well as the techniques and technologies to meet them - is a stage where much can be done. Enough information already is in hand to justify resource allocation for nutrition on a substantial scale in Kenya. The token efforts of the past are an inadequate and thus unacceptable response. It is no longer sufficient to think of nutrition in terms of projects that are doing something good or useful; they must be aimed at doing something of consequence.

Given that this study relates Infant and Child Mortality to nutritional status, it can thus be noted that

the variables so far used in this study should be tested at urban levels. This follows the contention that the majority of the world's population today is not subject to a system of vital registration. As a result, the exact dimensions and causes of Infant and Child Mortality in the rural areas of the developing world are not well known. The evidence available from local studies and from sample surveys such as the world fertility survey indicate that Infant and Child Mortality rates are consistently higher in the rural areas of the developing world as compared to corresponding rates in urban areas, the difference of rates being two to threefold higher.

Some of the major factors which were not considered in this study and are assumed to be contributing to higher Infant and Child Mortality in the rural areas include family formation patterns (such as early marriage and repeated pregnancies), nutritional factors from the household level and household socioeconomic factors. Infants and children in developing countries often die because of the inactive effect of malnutrition and infection, a process that usually starts at the moment of weaning and exposes to the risk of death in infants as well as children one to five years.

Childhood mortality due to the malnutrition - infection syndrome is today ten to twenty times higher in the rural areas of the developing world than in other settings. Reduction of mortality in this age group is primarily a function of the timely introduction of nutritionally appropriate weaning foods. This should be accomplished, however, without reducing the still widespread and beneficial practice of breastfeeding. Should the present trend of abandoing breastfeeding reach the rural areas, Infant and Child Mortality will inevitably rise even higher.

Environmental measures and health care services continue to be the cornerstone of programmes to reduce Infant and Child Mortality. However, more recent research has shown two factors whose importance had not been sufficiently recognized in the past: one is discrimination in the care and in the nutrition of female infants and children in districts and countries where male children are valued more; the other factor becoming evident as third world countries move along in their development is on the importance of educating women. Even in settings where socio-economic and environmental conditions are poor, and where health services are largely absent, Infant and Child Mortality levels can be significantly reduced by programmes of literacy and adult educatior directed to women.

However, different sets of policies have come up in the recent past in Kenya. Some of these policies touching on Infant and Child care include the Rural Health and Family Planning Programme started in 1982 by the Ministry of Health and the Integrated Rural Health and Family Planning Project, Phase II (1986-1989); and the District Development Policy. The concept of decentralized planning in Kenya was officially implemented in July 1st 1983 under the name 'District Focus for Rural Development'. The plan period is four years covering 1984-1988. The District Development Plan is to comply with the National Development Plan for the same period. The rationale for decentralization of planning is the desire to mobilize local resources for development. According to the Country's District Focus Policy, rural development and community involvement is emphasized. In addition priority is given to: Increasing the coverage and accessibility of health services in rural areas; further consolidation of both urban and rural curative and preventive services strengthening health environment capabilities particularly at the district level; creating alternative financing mechanisms. The government's strategy in strenghthening primary health care further calls for integration and expansion of maternal and child health care (MCH)/Family Planning; Malaria control, immunization, nutrition, prevention of diarrhoea diseases,

environmental sanitation, prevention of endemic diseases, supply of essential drugs and health education (MOH, September, 1985). But however, the expectations of decentralized planning is clearly expressed, but the concept has not been materialized to its full extent. The lack of an inter-sectoral list of priorities at district level also makes the potentials for integrating rural development relatively weak for the time being.

The other Kenyan government health policy under the Integrated Rural Health and Family Planning Project based in the Ministry of Health has been established to strengthen rural health and family planning services throughout the country. Objectives of the project are going to be introduced stepwise as a national programme. These objectives include: "to reduce Infant Mortality rate from 87 to 40 by 1989, by intensifying immunization, teaching mothers the importance of taking their children for immunization, encouraging breastfeeding and hence discouraging use of bottle feeding; to reduce mortality and morbidity caused by preventable childhood diseases, by emphasizing on immunization; to improve nutritional status, growth and development of infants and young children. However, the aforegoing objectives would be achieved by means that can be afforded by the individual and the community as a whole (MOH, September 1985).

It, however, can be suggested that the main policy of the Ministry of Health during the plan period should be to assist the people to attain better health by preventing, controlling and eradicating health hazards to the population. And that the strategies to attain these objectives should include emphasis on preventive and promotive health programmes touching on environmental sanitation, communicable disease control, vector borne disease control, Maternal-Child Health/Family Planning, health and nutrition education, and lastly increase of coverage of primary health services to the population. This would be implemented in conjuction with the already established Integrated Rural Health/Family Planning Programme.

Enhance accessibility of health care through bringing into full utilization the existing under-utilized health facilities, rectification of such health facilities will help strenghthen delivery of preventive programmes.

Nutrition policy and programmes in particular are vulnerable to lack of co-ordination between health and agricultural sectors. Malnutrition being a major problem points to the importance of integration in this field. A joint effort from the agriculture and health sector is needed to increase the total intake of food which is the main problem of malnutrition.

On geographical variations, the proportion of Infant deaths in the first months in Nyanza and Western Province is lower than elsewhere. This might indicate that infant deaths in these regions are due to environmental causes. Here early childhood mortality is an indication of environmental risk factor and poor nutrition. It can also be noted that other important contributions to high morbidity and mortality is lack of adequate water supply and half of the mothers in the country lacking formal education. Thus, High priority should be given to this factors if Infant and Child Mortality is to be reduced in this country.

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